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TRANSPORTATION AS A LIMITING FACTOR IN ECONOMIC DEVELOPMENT: MACKENZIE DISTRICT, CANADA'S NORTHWEST

by

Vladimir Salyzyn
April, 1958

University of Alberta
Faculty of Arts and Science
Department of Political Economy
Edmonton, Alberta.

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By

Vladimir Salyzyn

A dissertation submitted to the School of Graduate Studies in partial fulfillment of the requirements of the degree of Master of Arts

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CHAPTER ONE

A. GEOGRAPHIC FACTORS IN TRANSPORTATION

The eastern two-thirds of the Northwest Territories mainland lie in the Canadian Shield. The western portion borders on the eastern section of the Cordilleras. The Mackenzie Valley lies between these two rocky regions and forms the northern section of the Great Central Plain. This forms the heart of the Mackenzie District, which has an area of approximately 527,490 square miles.

The Mackenzie District may be remote and have problems of terrain and climate, but it has long had a transportation advantage over other generally similar regions of Canada (such as the Quebec-Labrador iron field) because of the great Mackenzie waterway.[1] This waterway is navigable for a distance of 1,700 miles. The system itself, with its tributaries, has approximately 2,500 miles of navigable river routes. In addition, freight in this area is also moved by air, road, tractor-train, and even by dog team.

The current problems and physical conditions of the freight movement in the Mackenzie District can be traced by following the actual freight route as it progresses northward. Each region will be described as it is reached.

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1. R. U. MAHAFFY, "The New North", Canadian Mining Journal, (December, 1954).

Edmonton is the "jumping off" place to the Mackenzie District. It is about 2000 miles by rail from the major markets and manufacturers in Eastern Canada and the U.S.A. Yellowknife is another 886 miles from Edmonton; Port Radium 1660 miles; and Aklavik 1898 miles.[2]

From Edmonton the freight moves north by rail to either Waterways in northeastern Alberta, or to Grimshaw to the northwest. Northern Alberta Railways terminates at both these points. In 1957, 135,603 tons were shipped to Waterways and 16,601 tons to Grimshaw for points north. In addition, 5,455 tons reached Hay River on the Great Slave Lake directly by truck from Edmonton. Let us first trace the Waterways route.

The warehouses at Waterways generally open for the season around the beginning of the fourth week in April. Freight is stored in the warehouse until shipment begins northward. The transportation firms generally announce that freight leaves north from Waterways during the first week in May. However, as a general rule, shipping out of Waterways does not begin until the middle of May. And this is just for the points along the Slave River. Lake Athabasca is usually unnavigable until the first of June, and in the fall it closes between the beginning and middle of October. By the end of May freight for most points

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2. R. G. ROBERTSON, A Brief presented To The Royal Commission on Canada's Economic Prospects, (November 22, 1955). Referred to later as The Gordon Commission.

north is on its way though some of it may not reach its destination until the middle of July because of ice conditions.

The Athabasca River from McMurray to Lake Athabasca is smooth and broad with an average width of 1800 feet. The current is about 3 miles per hour and the grade is 8 inches to a mile. There is continual silting and shifting so that new channels must be found each season.

Here lies one of the most serious impediments to northern water transportation. The delta is very shallow with continual shifts in the location of the channels. Because the west end of Lake Athabasca is shallow and turbid, the boats must skirt the area and travel well into the lake. West winds blow the lake water eastward adding to the shallowness. On the other hand, east winds in the spring clog up the channel with ice off the lake.

This whole area is in a low annual precipitation region (10" - 14") causing low water levels during the fall. In the spring the water is generally deep enough to facilitate navigation as a result of the run-off from the Rocky Mountains.

The necessity of going well out into the lake brings another problem concerning the construction characteristics of the boats. The boats must be shallow-draft for the river and other shallow areas and yet be seaworthy on the high waters

of the lakes. The compromise, like most compromises, does not really solve the problem. The result is that the equipment is not shallow enough for the low water areas, and too shallow for the treacherous navigation on the lakes.

> "Water levels on the Athabasca River constitute a serious problem notwithstanding that vessels and barges operating along it have maximum drafts of two feet, six inches."[3]

The result is unsatisfactory floating equipment with carrying capacity reduced by as much as 65 per cent, and a shortening of the navigation season.[4] In addition, extra boats may be needed to push the barges ahead along the sandy bottom, towing from the shore may be required, or partial unloading may have to be undertaken.

> "The biggest stumbling block to efficient use of floating equipment is the low water level on the Athabasca River."[5]

The ultimate solution is the construction of a dam to control the early season run-off. This project would cost millions.[6] However, the president of Northern Transportation Company Limited, Mr. W. J. Bennett, said on January 13th, 1950, at a meeting of the Northwest

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3. A. W. CURRIE, Economics of Canadian Transportation, (Toronto, 1954).

4. W. J. BENNETT, "Transportation in the Uranium Areas of the Northwest Territories", Canadian Mining and Metallurgical Bulletin, (December, 1952);

5. D. DANCIA, "Supply Lifeline of the Northwest" Saturday Night, (September 29, 1956).

6. Ibid. Dancia offers no suggestion as to the possible location of the dam.

Chamber of Mines in Edmonton, "Our preliminary investigation indicates that the plan might be feasible and at not too great a capital cost."

Moving north down the Slave River to Fort Fitzgerald, there is a 30 mile stretch of small rapids at Riviere des Roches that normally provides no difficulty. From the mouth of the Peace River on to Fort Fitzgerald the river is deep and broad (1800 feet to 3000 feet) and no navigational hazards are encountered. Fort Fitzgerald is 303 miles north from Waterways.

Between Fort Fitzgerald and Fort Smith is situated one of the two portages in the whole Mackenzie River system. The rapids run for 16 miles necessitating a portage of some 25 miles to Bell Rock (9 miles past Fort Smith) where an adequate dock could be constructed. Here freight is loaded on trucks of up to 30 tons capacity which move over one of two roads from Fort Fitzgerald to Fort Smith, and thence on to Bell Rock. The freight is unloaded from the barges at Fort Fitzgerald by forklifts and cranes and is either stored in the warehouse or loaded directly on to the trucks. After the 25 mile haul to Bell Rock the trucks are unloaded and the freight is either stored in the warehouse or piled in the freight yard if it is not to be loaded on barges directly.

The trucks may at times return to Fort Fitzgerald loaded with southbound freight generally made up of ore concentrate.

The portage lengthens transit time on the average by about five days.[7] The handling of freight manually has been reduced to only twice by the use of pallets beginning in 1949. But the need for transhipment still exists and hauling equipment, storage facilities, and crew must be maintained. A canal requiring locks is too expensive relative to present or foreseeable volumes of freight.[8] It would eliminate the need for a large capital outlay for equipment to handle the freight in transshipment as well as the wage bill for a sizeable labour force. A marine railway would also solve the problem, but again, at too high a cost.

From Fort Smith to the Great Slave Lake is a distance of 100 miles by air but 200 miles by the meandering Slave River. The Great Slave Lake is the fifth largest in North America. The east end is from 1000 to 1440 feet deep. The north end averages a depth of 100 feet. The west and south sides are shallow and Fort Resolution on the south shore had to build a long wharf well into the lake. Because of ice the Great Slave Lake usually cannot be crossed before the middle of June. In the fall it is unnavigable by between October the first

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7. A. W. CURRIE, Economics of Canadian Transportation, (Toronto, 1954).

8. W. J. BENNETT, "Transportation in the Uranium Areas of the Northwest Territories", Canadian Mining and Metallurgical Bulletin, (December, 1952).

and the fifteenth.

> "The large bodies of water are slower in breaking up in the spring, and are, therefore, the delaying links in the chain of navigation."[9]

Even after the ice breaks the winds may keep it jammed for weeks at the channel entrance. Storms on the Great Slave Lake delay ships often for weeks.

From the lake the navigational route moves north into the Mackenzie River. Forty-five miles from the lake the river narrows at Fort Providence, 660 miles from Waterways.

On from Fort Providence to Fort Simpson at the mouth of the Liard River is a distance of 156 miles. Just before Fort Providence navigation encounters fast water (6 miles per hour) where a full upstream load cannot be pushed. 70 miles south of Fort Simpson fast water is met again. Northward at Green Island Rapids, 12 miles from Fort Simpson are found some real hazards. Because of the existence of glacial boulders at this point new channels are formed each year. The first boat of the season has no aids to navigation.

> "Here many boats and barges have been wrecked, and a large tonnage of freight has gone to the bottom of the river." [10]

From Fort Simpson the route moves to Fort Wrigley and thence to Fort Norman. From Fort Norman the freight

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9. J. L. ROBINSON, "Water Transportation in the Canadian Northwest", Canadian Geographical Journal, (November, 1945).

10. H. W. HEWETSON, Transportation in the North-West in C.A. Dawson, The New North-West, (Toronto, 1947), 214.

moves two ways: north along the Mackenzie to Norman Wells or east up the Bear River and across Great Bear Lake to Port Radium. The Great Bear Lake cannot be crossed before the middle of July, and the season closes late in September.

In the case of the Bear Lake movement, the freight moves first some 45 miles along Bear River, thence over an 8 mile portage and on again up the river for another 45 miles. The next lap is one of 200 miles across the lake to Port Radium. The Bear River is shallow, narrow, and treacherous. Very shallow draft tugs are used. For the lake trip freight is transferred to tugs built especially for this crossing. Not only is the route from, say, Edmonton to Port Radium long and round about, but from 16 to 20 handlings of freight are required. The number varies with the number of times warehousing is necessary enroute. Six handlings are needed between the Mackenzie River and the vessels on Great Bear Lake.

The freight destined through Norman Wells passes over a wide (4 miles), smooth river. Norman Wells and its refinery are the source of practically all the movement of petroleum products north and south on the Mackenzie River system. Further downstream lies Fort Good Hope and a further stretch of troublesome rapids and narrows. Southernmost are the Sans Sault Rapids which at high water are safe but become very dangerous at low water. North again lie the Ramparts, easily navigated during low water levels

but becoming too rapid at highwater for easy navigation. The Ramparts drop 20 feet in 7 miles, but the hazard is to be found not so much in the drop as in the 7 mile per hour current. Difficulty in navigation is extreme on an upstream trip. Fort Good Hope is 1203 miles by water from Waterways.

The rest of the river route to Arctic Red River and Fort McPherson is smooth, as is the trip into the Mackenzie River Delta itself. Aklavik, East-3, Reindeer Station, and Tuktoyuktuk are easily reached. Finally more distant points along the Arctic Coast are reached, freight moving to such points consisting mainly of Dew Line materials and supplies.

In tracing the Grimshaw route we have only the gap between Grimshaw, Alberta, and Hay River, on Great Slave Lake, N.W.T. to describe. Here, joining the two points, lies the Mackenzie Highway built in 1948 as a result of a joint Alberta-Federal Government project. It is 385 miles long, 20 feet wide, gravel surfaced and open during the entire year. The Federal Government paid for all of the cost of the 81 miles in the N.W.T. and two-thirds of the cost of the section of the road in Alberta. The maintenance cost of the N.W.T. section is about $100,000.00 per year.

There is also a 70 mile gravel surfaced road from the Mackenzie Highway to Pine Point on the south shore of Great Slave Lake, built in 1952.[11]

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11. Department of Resources and Development, Transportation and Communication in the Northwest Territories, 1953.

In the winter a roadway is ploughed as required over Great Slave Lake from Hay River to Yellowknife. Tractor trains haul freight over the lake during the season that usually lasts about 100 days beginning at approximately the middle of January when the ice is frozen to the required 40 inches or so. The train generally consists of a tractor pulling about ten 15-ton sleds 24 hours per day. Such sled trains average about 50 miles per day. Rough ice and cold weather are grave problems and all but the slightest grades are avoided.[12] This type of operation is being reduced greatly because of its cost relative to air and highway transportation according to one observer. We will return to this later. In the winter of 1957 trucks have been hauling freight overland from Hay River to Yellowknife.[13] A winter road from Hay River to Norman Wells has been used for this purpose in the past.

The air route facilities in the Mackenzie District are well developed. There are airports at Fort Smith, Hay River, Yellowknife, and Fort Simpson. There is also an air field at Fort Providence. In addition there are landing strips all along the Mackenzie Valley located at Pine Point, Fort Resolution, Fort Wrigley, Bennett Field off Fort Norman, Sawmill Bay near Port Radium, Norman Wells, and Aklavik.

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12. H. W. HEWETSON, Transportation in the North-West, in C. A. Dawson, The New North-West, (Toronto, 1947), 219.

13. EDMONTON JOURNAL, January 26, 27, 1957.

There are also numerous seaplane anchorages. There is a regular passenger and freight service all the way to Aklavik. Yellowknife receives daily air service. The mining firms use airplanes to move ore, mining supplies, and personnel regularly between Edmonton and Port Radium and between Edmonton and Beaverlodge. Charter flights are available anytime to any place in the area. There is a firm that specializes in this service. Bases from which such service is available are located at Fort Smith, Yellowknife, Hay River and Aklavik.

Air transportation is the only form available to many regions in the north. During the winter for points north of the railways and road systems air service provides the only link for over six months of the year. The airplane is well suited to the "pocket" type of development prevalent in the north. It need not push its way across intervening ground.

For certain kinds of transportation dog teams will always be the best. Where routes pass over pack-ice on the sea or rocky trails the dogs will always get to their destination regardless of weather. However, they are slow and can haul only a limited weight. The average sled is loaded to about 1,100 pounds and is drawn by from 7 to 15 dogs. A good pack dog will carry from 35 to 40 pounds.[14]

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14. Department of Resources and Development, Transportation and Communication in the Northwest Territories, 1953.

B HISTORY OF TRANSPORTATION

The Department of Resources and Development states that the history of transportation in the Northwest Territories can be divided into approximately two periods; viz. the period before and the period after the use of the aeroplane.[15] This statement is misleading in some respects. Actually all forms of transportation have shown a continual and regular growth and no one form has eclipsed another. Each new medium has proved to be complementary rather than substitutive. In other words, the whole system of transportation has grown together. New media have been added to supplement existing ones. First there was only the water, then the air, and after that came the roads. Next will be the railway.

On the water routes, canoes were the first to be used and they are still used on small rivers and lakes. Later in 1826 canoes were supplemented by the York boats of the Hudson's Bay Company. The York boats were of shallow draft, 40 feet long with a 10 foot beam, and shaped like a whale boat. In 1884 steamship service was inaugurated between Fort McMurray and Fort Fitzgerald in the Alberta upper reaches of the system. In 1886 the steamer "Wrigley" began service from Fort Smith on the Alberta border north to Fort McPherson. In 1902 the first stern wheeler was introduced on the lower Mackenzie. Barges were introduced after World War 1. Now

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15. IBID.

only diesel powered tugboats equipped with radios are used to push barges along the river routes.[16] During all this time freight volume has grown rapidly.

Air transportation was introduced first by Imperial Oil Limited in the winter of 1920-21. Because of its many lakes, the north is well suited to aircraft fitted with pontoons or skis. In 1936, 13,500 tons of air freight were hauled to the entire Canadian north to points "north of the tracks".[17] The Second World War brought into existence improved landing strips throughout the north in the Mackenzie District. At present there are paved airstrips at Fort Smith and Yellowknife. In addition, the Department of Transport plans to start paving an airstrip at Norman Wells in 1958.

The first all-weather road into the Northwest Territories was built in 1948. This was the Mackenzie Highway from Grimshaw, Alberta, to Hay River on the Great Slave Lake. Many winter roads existed previously over which tractors hauled freight.

There are three principal water common carriers in the Mackenzie River area. They are under the jurisdiction of the Board of Transport Commissioners. The major function of this body is to regulate freight rates as set up under

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16. J. L. ROBINSON, "Water Transportation in the Canadian Northwest", Canadian Geographical Journal, (November, 1945).

17. L. ROBERTS, "Big Capital, Bright Future in North Air Freight," FINANCIAL POST, (June 15, 1957).

the Transport Act, 1938.

The largest of these carriers is Northern Transportation Company Limited, which was originally formed to carry ore and mining equipment to and from Port Radium, N.W.T. for its parent Company, Eldorado Mining and Refining. Both of these are now crown corporations. The entire operation of Northern Transportation Co. Ltd. is now conducted as a common carrier. Except for the Peace and Liard Rivers, the whole Mackenzie watershed is served by it. It is the only carrier operating in the Great Bear area. In 1957 the Company operated a fleet of 21 motor vessels and over 100 barges out of Waterways and Fort Smith. The firm carried approximately 78% of the total water freight hauled in the area.

The second largest of the Companies operating as common carriers is Yellowknife Transportation Company Limited. The major part of its operations involves the hauling of petroleum products. In 1956, 76% of the total tonnage handled by this firm was made up of petroleum products. This Company does not operate south of Fort Smith, but its operations extend north to the Arctic Ocean. It does not operate on the Liard, Peace, or Great Bear Rivers. In 1957 the firm operated six vessels and about 20 barges out of Hay River.

The smallest major common carrier is McInnes Products Limited, principally a fishing firm, catering to markets in the U.S.A., and operating in the Great Slave Lake and Lake Athabasca areas. It is the only firm offering refrigeration

service. Its overall operations are limited to the area from Waterways to the Great Slave Lake. Its function as a common carrier is declining, while its fishing operations are expanding. McInnes Products Limited has four river boats in service, two out of Hay River and two from Waterways. It also operates 13 barges, 5 of which are refrigeration barges.

There are two additional individual licensed common carriers. Charles Sanders operates from Yellowknife and Phillip D'aoust from Fort Resolution. These firms operate only one or two ships each and limit their activities to within the confines of the Great Slave Lake and the lower Slave River.[18]

In addition to the above common carriers there are two firms hauling water freight for themselves.

One of these is the Hudson's Bay Company. At one time this Company was the sole operator in the north, and for many years carried the bulk of the freight throughout the whole north including the area from Peace River in Alberta to the coastal areas on the Arctic Ocean. It curtailed the operations on the Peace River in 1952 because of severe competition from trucking firms; but it still carries freight into the Arctic. Since 1948 it has stopped operating as a common carrier, except for the short period on the Peace River, and now carries only its own freight to its trading posts.

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18. The Board of Transport Commissioners for Canada hearing at Edmonton. January 30-31, 1950.

In 1957, the Hudson's Bay Company operated two vessels out of Fort Smith and one from Waterways in addition to the three vessels in the Western Arctic. In the same year the firm handled approximately 6,500 tons of freight.[19]

The other firm, a new-comer to the northern shipping scene, operates solely between Waterways and Lake Athabasca. The firm, Gunnar Water Transport Division, started operations in 1956 to supply its parent, Gunnar Mines, with mining equipment and to haul ore on the return trip. In 1957 it operated 2 tugs and 6 barges and handled about 18,000 tons.

There are four major firms operating an air freight service. The only regularly scheduled operator is Canadian Pacific Airlines, from which information concerning operations was unobtainable.

Another firm, Pacific Western Airlines, runs a charter passenger and freight air service throughout the whole area catering mostly to new and remote mining developments. The firm started in 1949 as Associated Airways and was taken over in 1955 by Pacific Western Airlines. During this nine year period a yearly average of 2,440 tons was carried of which 9% was mail.

The two remaining firms function as subsidiaries for their parent mining companies. Eldorado Aviation is a subsidiary of Eldorado Mining and Refining. It hauls mining

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19. In the Spring of 1958 Hudson's Bay Company sold all of its marine equipment to Northern Transportation Company Limited and ended 135 years of operations on the water routes in the north.

equipment to and ore from both Port Radium, N.W.T. and Beaverlodge, Saskatchewan. Its tonnage northbound and southbound is closely matched. The total freight hauled in the nine years 1948-1956 was 29,400 tons. In 1956 over 7,000 tons were hauled by one DC 3 and one Curtis Commando FC1.

Gunnar-Nesbitt Aviation Limited is a subsidiary of Gunnar Mines and started operating in 1955. In 1957 the firm hauled 1,150 tons of freight. As with Eldorado Aviation its northbound and southbound freight was closely matched. The firm operates solely in the Lake Athabasca area.

The main firm operating on the Mackenzie Highway is Grimshaw Trucking, Grimshaw, Alberta. Two other firms, with bases in Edmonton, haul by truck from Edmonton to Hay River. These are Veteran Transfer Company and Adby Construction Co. Ltd. Both are new additions to the truck operators in the area. Yellowknife Transportation is the major tractor train operator on the Great Slave Lake.

C. CURRENT PATTERNS IN FREIGHT MOVEMENTS

In tracing the actual freight movements on the water routes we find that in 1957 there were 134,185 tons shipped northward from Waterways and 22,300 tons from Hay River. 10,050 tons were shipped south to Waterways and 2,879 tons south to Hay River.

Tracing this movement for 1957 on the eastern route the freight moved northward from Waterways to be divided up at the west end of Lake Athabasca. Two-thirds of it moved into the Lake Athabasca Area and only one-third of the freight that left Waterways moved further north. With the addition of lumber picked up in the Peace River area 100,893 tons entered Lake Athabasca and 40,500 tons moved on to Fort Fitzgerald.

Of the 10,050 tons reaching Waterways from the north 13% came from Lake Athabasca and 63% from the lumbering area around the mouth of Peace River. The remainder came from the Mackenzie District.

At the portage between Fort Fitzgerald and Fort Smith, 27,077 tons were hauled to Bell Rock for delivery further north. Another 13,423 tons were loaded on to trucks at Fort Fitzgerald and hauled for delivery to Fort Smith. 4,812 tons were portaged from Bell Rock to Fort Fitzgerald on their way south.

Out of the 27,077 tons reaching the Great Slave Lake

from Waterways and the 22,300 tons from Hay River, 45% (22,196 tons) went to Yellowknife and 51% (25,411 tons) to Providence for points along the Mackenzie River, Port Radium, and the Arctic Coast. The remaining 4% went to settlements on the shores of Great Slave Lake, the bulk to Fort Rae, north of Yellowknife.

16,421 tons moved south from Fort Providence, of which 11,157 tons went to Yellowknife, 2,382 tons to Hay River, and 2,882 tons south towards Waterways.

There was little change in either northbound or southbound freight until Fort Norman was reached. Here 34% (8,208 tons) of the northbound freight went to Port Radium, and 66% (15,700 tons) went on to Norman Wells. At Fort Norman there were 24,261 tons of southbound freight of which 6,556 (27%) went to Port Radium and the remainder up the Mackenzie River.

Only 230 tons reached Norman Wells from the north. On the other hand, 28,300 tons moved north from there. Of this, 4,669 tons went to the Arctic, 2,298 to Fort McPherson, and the remaining 21,333 tons to points on the Mackenzie River Delta.

The latest figures available on air freight movements in the area are for 1956. Only statistics for the mining company hauls are obtainable on a point to point basis. In 1956 mining company air hauls freighted 3,113 tons from Edmonton to the Uranium City area. 1,289 tons more were hauled from Fort McMurray to this area making a total of

4,402 tons air freighted northward to the mining developments on Lake Athabasca. At the same time 2,563 tons were removed from there, 77 tons going to Fort McMurray and the rest to Edmonton. The bulk of this was ore products. The northbound: southbound ratio was 1.7:1.

The other operation of the mining companies involved the movement of 495 tons to Port Radium from Edmonton and a return load of 565 tons made up mostly of ore. Here the northbound: southbound ratio was 0.88:1.

The point to point analysis of air freight hauled by Canadian Pacific Airlines is unobtainable. However, their overall picture in the N.W.T. in 1956 showed 815 tons hauled northward and another 172 tons southward, giving a 4.7:1 ratio of northbound: southbound movements.

The charter flights of Pacific Western Airlines, rated at 100% capacity for each trip, totalled 2,257 tons northbound and 4,897 tons southbound. These operations tend to be off the regular routes served by Canadian Pacific Airline

Turning now to the overland Hay River route, 5,455 tons were hauled north directly from Edmonton by trucks along the Mackenzie Highway. The remainder, 16,601 tons, was first moved by railway from Edmonton to Peace River and Grimshaw, at the end of the Northern Alberta Railways line, and thence on by trucks along the Mackenzie Highway to Hay River. The southbound freight from Hay River amounted to 4,560 tons. I 1957, 2,700 tons were trucked to Grimshaw and then moved to

Edmonton by rail. The remaining 1860 tons were hauled by trucks all the way from Hay River to Edmonton.

All the freight between Edmonton and Waterways is moved by the Northern Alberta Railways. There is no road connecting Waterways with Edmonton.

CHAPTER TWO

CHANGES IN PATTERNS OF FREIGHT MOVEMENTS, 1948-1957

This chapter will trace the freight movements through key points in the system for the 1948 - 1957 period. Trends of growth in the specific areas will be examined. Also analysed will be the northbound-southbound ratios. The movements on water only will be examined, except for the Port Radium area where air freight will also be considered. It will be impossible to trace the freight hauled by air to any of the other points, but fortunately the amounts involved, being small, will not affect the results significantly.

The following table sets out the total volume of freight moved into and out of the Mackenzie River System area at the two entrance points, Hay River and Waterways.

	Northbound (Tons)			Southbound (Tons)		
Year	Waterways	Hay River	Total	Waterways	Hay River	Total
1948	23,615	2,757	26,372	2,881	2,000	4,881
1949	20,834	3,073	23,907	2,629	3,229	5,858
1950	21,772	4,041	25,813	3,000	3,104	6,104
1951	30,304	2,734	33,038	4,401	5,181	9,582
1952	47,139	1,706	48,845	3,195	2,435	5,630
1953	54,606	1,667	56,273	3,221	2,421	5,642
1954	63,358	1,275	64,633	2,954	3,064	6,018
1955	88,698	4,857	93,555	3,279	5,057	8,336
1956	143,372	20,398	163,770	2,760	7,358	10,118
1957	133,171	21,966	155,137	9,554	4,560	14,114
Total	626,869	64,474	691,343	37,874	38,409	76,283
Average per year:	62,687	6,447	69,134	3,787	3,841	7,628

In order to see the relative importance of Waterways and Hay River in the northward and southward movements the above table is here changed into percentages.

Year	Percentage Northbound From Waterways	Hay River	Percentage Southbound From Waterways	Hay River
1948	89.5	10.5	59.0	41.0
1949	87.1	12.9	44.9	55.1
1950	84.3	15.7	49.1	50.9
1951	91.7	8.3	45.9	54.1
1952	96.5	3.5	56.7	43.3
1953	97.0	3.0	57.1	42.9
1954	98.0	2.0	49.1	50.9
1955	94.8	5.2	39.3	60.7
1956	87.5	12.5	27.3	72.7
1957	85.8	14.2	67.7	32.3

Northbound:Southbound Ratio

Year	Waterways	Hay River	Total
1948	8.2	1.4	5.4
1949	7.9	1.0	4.1
1950	7.3	1.3	4.2
1951	6.9	0.5	3.4
1952	14.8	0.7	8.7
1953	17.0	0.7	10.0
1954	21.4	0.4	10.7
1955	27.1	1.0	11.2
1956	51.9	2.8	16.2
1957	13.9	4.8	11.0
1948-1957	16.6	1.7	9.1

| | | |

In the last ten years Waterways handled approximately ten times as much of the northbound freight as did Hay River. The ratio for the last two years is 6.5:1. The southbound freight, however, has been equally split between the two. 65 percent of the southbound freight from Hay River is made up of fish caught in the Great Slave Lake. This explains the relatively large amount of the southbound freight from Hay River. All this results in a ten year average northbound:southbound ratio of 16.6:1 at Waterways and only an average 1.7:1 ratio for the same period at Hay River. The overall northbound-southbound ratio is 9.1:1.

A large amount of the freight out of Waterways never reaches the Northwest Territories. Thus, to study the inflow and outflow of the freight in the Mackenzie District we have to concentrate on Fort Smith and Hay River, the key entrance points to this area.

The charts are drawn up using an analysis similar to the one used in comparing Waterways with Hay River.

Of key significance is the 1948 - 1957 northbound:southbound ratio of 4.9:1 for the Mackenzie District by itself as compared with the 9.1:1 ratio for all northbound freight through Grimshaw and Waterways and the 16.6:1 ratio at Waterways alone. Thus the low southbound load factor is not so acute in the Mackenzie District as in the Waterways - Lake Athabasca area. The 4.9:1 northbound:southbound ratio for

Year	Northbound (Tons) To and Through Fort Smith	To and Through Hay River	Total	Southbound (Tons) From and Through Fort Smith	From and Through Hay River	Total
1948	22,805	2,995	25,800	2,848	2,000	4,848
1949	15,769	3,135	18,904	2,542	3,229	5,771
1950	18,241	4,173	22,414	2,746	3,104	5,850
1951	21,429	2,972	24,401	3,437	5,181	8,618
1952	19,016	1,741	20,757	1,299	2,435	3,734
1953	18,241	1,681	19,922	2,516	2,421	4,937
1954	19,532	1,282	20,814	2,248	3,064	5,302
1955	26,824	4,882	31,706	2,089	5,057	7,146
1956	33,185	20,417	53,602	1,747	7,358	9,105
1957	40,415	21,997	62,412	1,965	4,560	6,525
Total	235,457	65,275	300,732	23,437	38,409	61,846
Average	23,546	6,528	30,073	2,344	3,841	6,185

Year	Fort Smith:Hay River Ratio: Northbound	Southbound	Northbound:Southbound Ratio: Fort Smith	Hay River	Total
1948	7.6	1.4	8.0	1.5	5.3
1949	5.0	0.8	6.2	1.0	3.3
1950	4.4	0.9	6.6	1.3	3.8
1951	7.2	0.7	6.2	0.6	2.8
1952	10.9	0.5	14.6	0.7	5.6
1953	10.9	1.0	7.3	0.7	4.0
1954	15.2	0.7	8.7	.04	3.9
1955	5.5	0.4	12.8	1.0	4.4
1956	1.6	0.2	19.0	2.8	5.9
1957	1.8	0.4	20.6	4.8	9.6
1948-57	3.6	0.6	10.0	1.7	4.9

the Mackenzie District is calculated for movements across the Alberta - Northwest Territories boundary. However, in considering only the movements in the area north of Hay River and Fort Smith (that is, excluding in the northbound movement the freight hauled from the south for delivery at Hay River and Fort Smith and adding for the southbound movement the freight from the north destined to these points) an even smaller 1948 - 1957 northbound:southbound ratio of 3 : 1 is obtained. This 3 : 1 ratio is again this high only because of the extremely high northbound:southbound ratio of 93 : 1 between Hay River -

FREIGHT MOVEMENTS AT YELLOWKNIFE

Year	Northbound to Yellowknife (tons)	Southbound From Yellowknife (Tons)	Northbound: Southbound Ratio
1948	10,609	11	964
1949	12,849	96	134
1950	11,807	74	160
1951	11,890	76	156
1952	10,657	263	41
1953	10,113	172	59
1954	11,662	142	82
1955	13,043	336	39
1956	26,980	199	1356
1957	22,196	163	1362
Total	141,806	1532	93
Average 1948-57	14,181	153	

Fort Smith and Yellowknife for the 1948 - 1957 period. This is illustrated in the table above.

Of the 245,847 tons shipped north of Hay River and Fort Smith in the 1948 - 1957 period 141,806 or 57.7 per cent went to Yellowknife. The corresponding import percentages over the ten years ranged from 44.9 per cent in 1957 to 83.8 per cent in 1949.

The large amount of freight shipped to Yellowknife is worthy of special note. First, it has a large population which is approximately one half of the total population of the Mackenzie District. Secondly, it has large mining developments expanding continuously. In addition, Yellowknife serves as the hub of the mining explorations in the whole Mackenzie District. Also a large number of tourists are being attracted annually to Yellowknife.

Almost nothing leaves from Yellowknife by water for the south creating the very lop-sided northbound:south-bound ratio in the freight movement. The only export item produced at Yellowknife is gold which is of a high value but insignificant as a freight item. This characteristic results in it being shipped out by air.

The 500 miles or so between the Great Slave Lake and Fort Norman present a new and different condition in the freight movement. Here, for the 1948 - 1957 period, the amount of freight moved south was 141 per cent of that moved north. The reason for this is the large southward shipments

FREIGHT MOVEMENTS BETWEEN THE GREAT SLAVE LAKE AND FORT NORMAN (Tons)

Year	Northbound	Southbound	Northbound: Southbound Ratio
1948	7,920	15,788	2.0
1949	3,825	10,149	2.7
1950	4,799	14,564	3.0
1951	8,698	16,744	1.9
1952	7,122	13,769	1.9
1953	7,421	14,585	2.0
1954	7,890	13,286	1.7
1955	14,445	23,155	1.6
1956	17,643	18,005	1.0
1957	31,790	17,700	0.6
Total	111,553	157,745	1.4

of petroleum products from Norman Wells and the uranium ore concentrates from Port Radium. The trend for the last few years, however, has been towards a closer match of the movements both ways. As can be seen in 1957, the amount moved north exceeded the southward movement for the first time. The reason for this change or trend was the abnormally large movements destined for the Dew Line in the last three years. Thus, for this relatively large section of the system the northbound:southbound freight imbalance has not been a problem and is becoming even less so.

NORTHBOUND FREIGHT FROM NORMAN WELLS (Tons)

ORIGIN

Year	Norman Wells	South of Norman Wells	Total
1948	6,950	2,447	9,397
1949	6,503	608	7,111
1950	6,512	1,346	7,858
1951	1,712	1,461	3,173
1952	7,286	1,172	8,458
1953	7,886	1,809	9,695
1954	10,429	1,803	12,232
1955	21,533	7,158	28,691
1956	10,111	7,063	17,174
1957	14,297	14,891	29,188
Total	93,219	39,758	132,977

1948-57 Northbound:southbound ratio - 616

The movement of the freight north of Norman Wells however is even more one sided than the movement to Yellowknife. The reason is that this area has so far marketed nothing other than fur for shipment southward. The amount has been small in any case and is decreasing continually. On the other hand, administration, exploration, research, and national defence have caused a great deal of supplies to be moved into the area north of Norman Wells. A large portion of this is fuel oil from Norman Wells. The northbound:southbound ratio is almost meaningless

because of its large size. The movement here is basically all northward.

Port Radium is the only point that can be analysed for both the water and air movements of freight. The northbound:southbound water freight ratio between Fort Norman and Port Radium is 6.5: 1 for the 1948 - 1957 period. Over one half of this ratio is the result of the shipment of petroleum products from Norman Wells northward from Fort Norman to Port Radium. Three times as much freight is brought in to Port Radium from the south as is shipped out by boat from Port Radium to points south.

FREIGHT MOVEMENT AT PORT RADIUM (Tons)

Year	Northbound to Port Radium By Water	Northbound to Port Radium By Air	Southbound to Port Radium By Water	Southbound from Port Radium By Water	Southbound from Port Radium By Air
1948	1,728	751	6,363	1,375	731
1949	905	680	3,665	1,938	590
1950	1,152	694	4,469	2,322	705
1951	5,517	566	5,150	2,550	572
1952	5,469	754	4,116	948	643
1953	5,233	633	7,728	2,262	645
1954	5,587	502	6,117	1,656	522
1955	6,248	427	7,022	1,715	448
1956	5,875	495	7,512	1,391	565
1957	8,208	---	6,556	1,261	---

NORTHBOUND:SOUTHBOUND RATIOS

Year	BY WATER Between Port Radium, Fort Norman	BY WATER Between Port Radium, Waterways	BY AIR Between Port Radium, Edmonton
1948	5.9	1.3	1.0
1949	2.4	0.5	1.2
1950	2.4	0.5	1.0
1951	4.2	2.2	1.0
1952	10.1	5.8	1.2
1953	5.7	2.3	1.0
1954	7.1	3.4	1.0
1955	7.7	3.6	1.0
1956	9.6	4.2	0.9
1957	11.7	6.5	
1948-56			1.0
1948-57	6.5	3.1	

The northbound movement by air from Edmonton to Port Radium is evenly matched by the southbound movement back to Edmonton. If all the freight were moved by water the northbound:southbound ratio between Port Radium and Waterways would be 2.5: 1 instead of 3.1: 1. The air operation, therefore, increases the northbound:southbound ratio for water movements. This aggravates water load factors on the Waterways to Great Slave Lake section and also on the route from Fort Norman to Port Radium. However, this higher northbound:south-

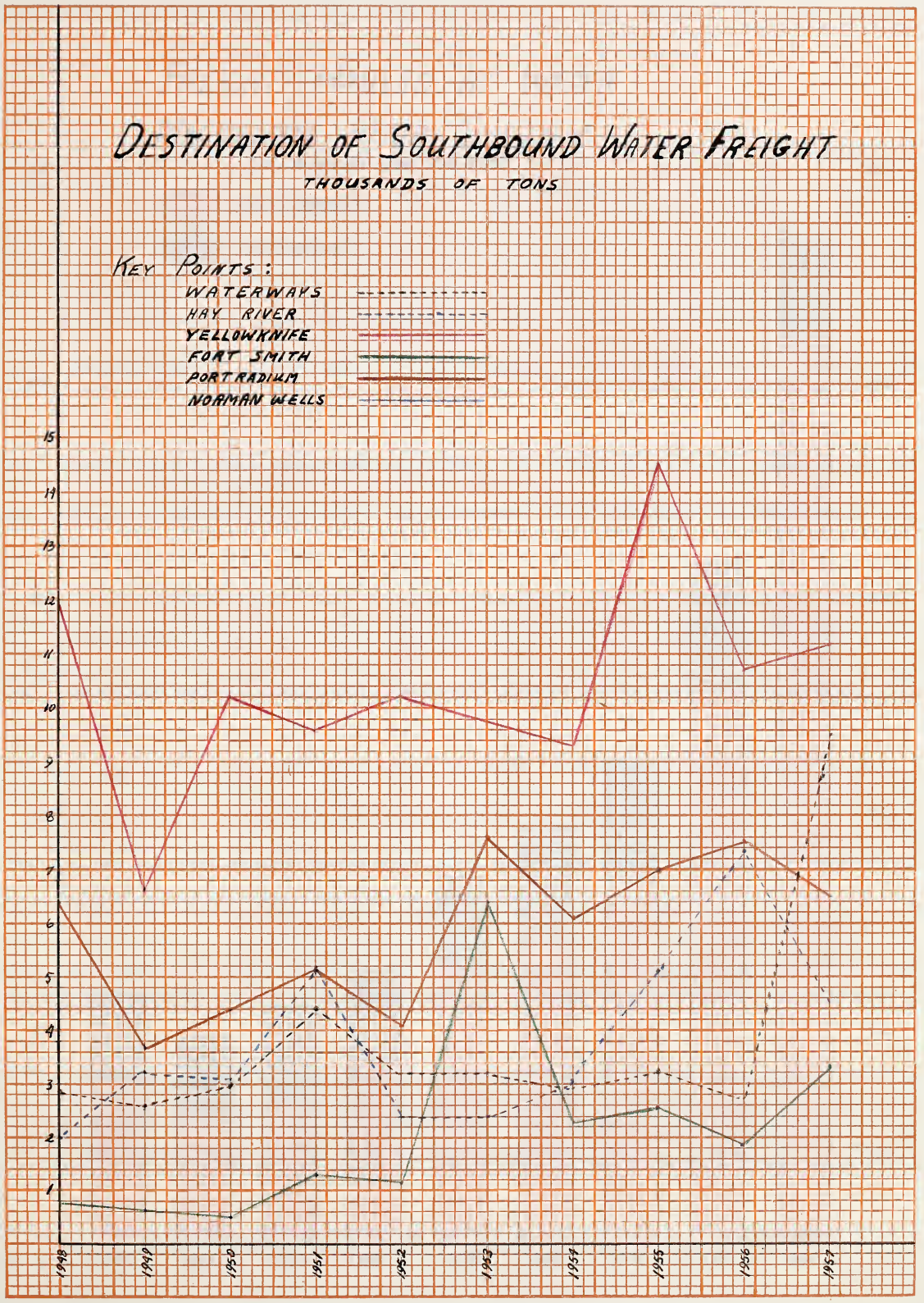
bound ratio decreases the southbound:northbound ratio between the Great Slave Lake and Fort Norman. Since air movement is more costly it is more important to maximize round-trip load factors on airplanes than on barges.

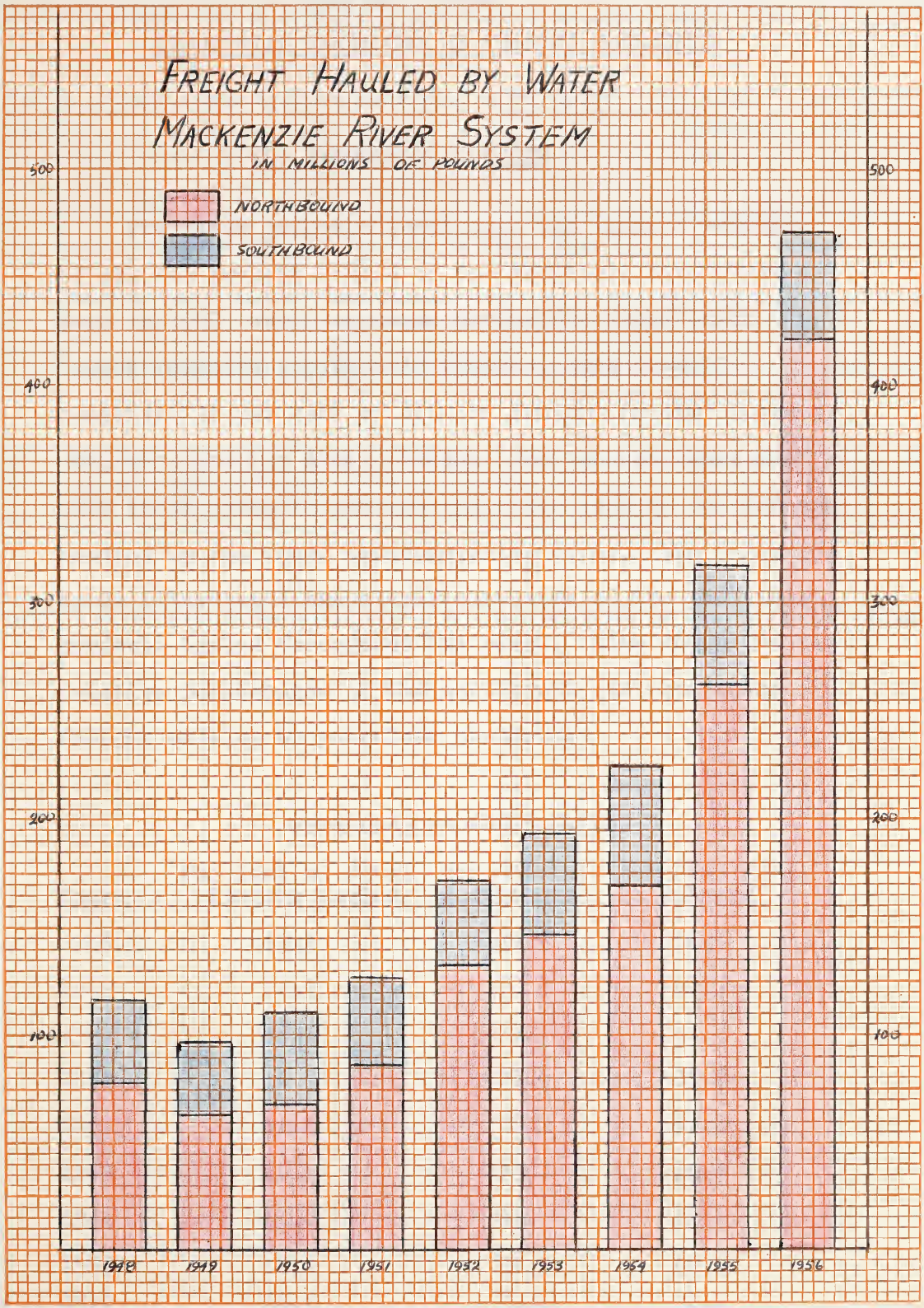
DESTINATION OF NORTHBOUND WATER FREIGHT

THOUSANDS OF TONS

KEY POINTS:

- NORTH OF NORMAN WELLS
- NORMAN WELLS
- PORT RADIUM
- YELLOWKNIFE
- FORT SMITH


DESTINATION OF SOUTHBOUND WATER FREIGHT
THOUSANDS OF TONS
KEY POINTS:
WATERWAYS
HAY RIVER
YELLOWKNIFE
FORT SMITH
PORT RADIUM
NORMAN WELLS
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957


FREIGHT HAULED BY WATER
MACKENZIE RIVER SYSTEM
IN MILLIONS OF POUNDS
NORTHBOUND
SOUTHBOUND
500
400
300
200
100
1948
1949
1950
1951
1952
1953
1954
1955
1956

CHAPTER THREE

INDUSTRIAL BREAKDOWN OF FREIGHT MOVEMENTS

A. PETROLEUM PRODUCTS

Petroleum products constitute the largest portion of all the freight hauled on the Mackenzie River System. Even in 1957, when petroleum products reached their lowest relative position in decades, such products comprised 39 per cent of all the freight handled between Waterways and the Arctic Ocean. For the ten years 1948 - 1957 these products averaged 49.4 per cent of the tonnage handled by the water transportation firms. The following table illustrates the significant size of the petroleum products hauled throughout the years. Also shown are the relative percentages of the southbound and northbound freight made up by petroleum products.

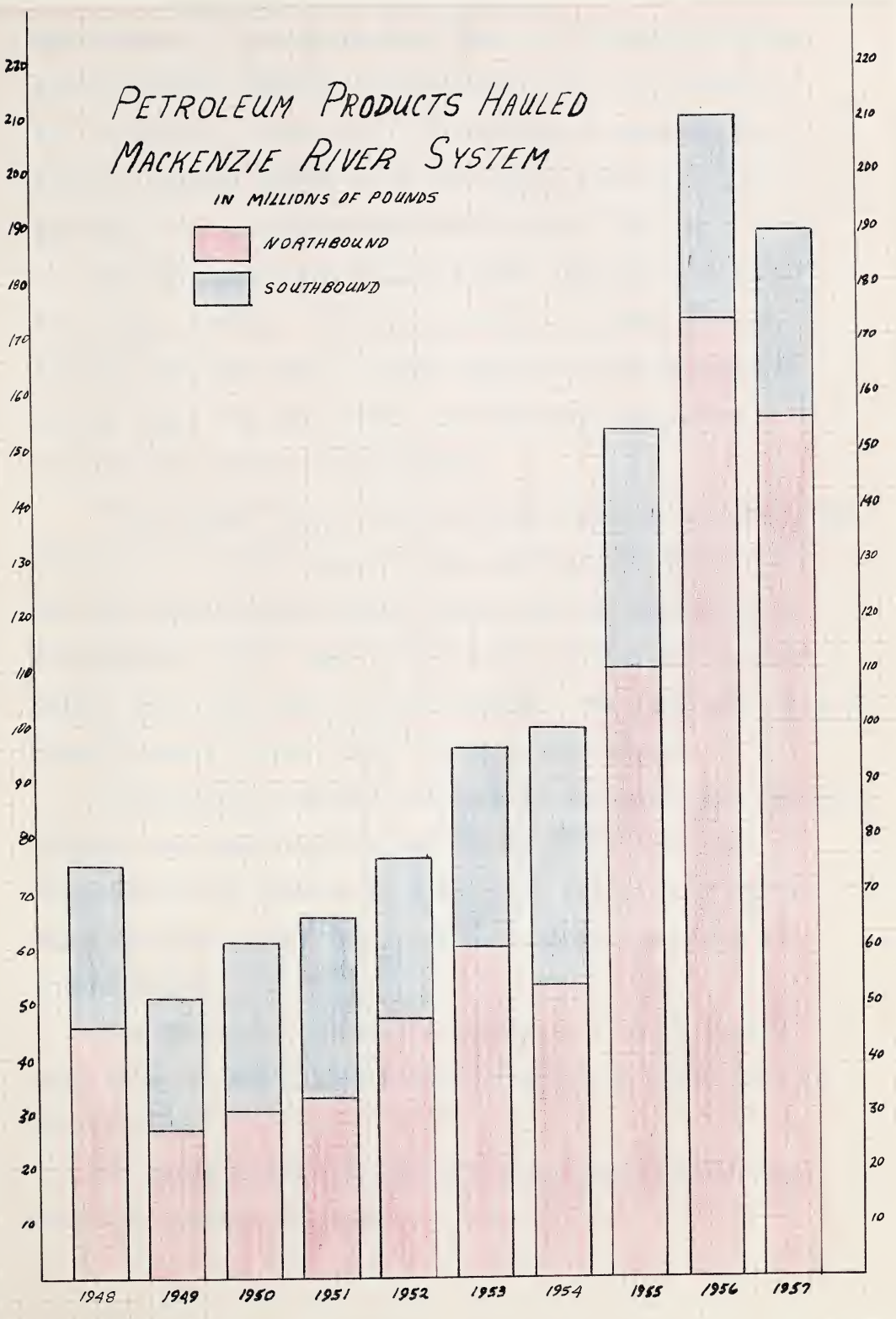
PETROLEUM PRODUCTS HAULED

Year	Per Cent of Total Freight Hauled	Per Cent of Southbound	Per Cent of Northbound
1948	65.2	79.5	58.3
1949	52.7	70.9	42.9
1950	55.3	72.3	44.5
1951	50.9	79.6	37.8
1952	44.6	76.3	35.2
1953	49.4	76.7	40.7
1954	44.0	83.3	31.2
1955	48.4	78.9	42.0
1956	44.6	74.4	41.1
1957	39.0	Not available	

There is no significant trend in either the northbound or southbound movement of the petroleum products. It appears, however, that the relative importance of the petroleum products is on a slow, but marked, trend downward. In spite of the fact that the actual amounts of petroleum products hauled are increasing rapidly they cannot keep up with the rate of growth of the other goods hauled. Using 1948 as a base year, the following index represents the growth in the petroleum products hauled and the rate of growth of all products between 1948 and 1957.

Year	Petroleum Products	All Products
1948	100	100
1949	67	83
1950	81	95
1951	86	109
1952	101	148
1953	127	167
1954	131	193
1955	202	273
1956	278	406
1957	250	417

In 1956, 39 per cent of the freight hauled by Northern Transportation Company Limited was made up of petroleum products. And, as noted earlier, petroleum products made up 76 per cent of the freight hauled in 1956


PETROLEUM PRODUCTS HAULED
MACKENZIE RIVER SYSTEM
IN MILLIONS OF POUNDS
NORTHBOUND
SOUTHBOUND
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
1948
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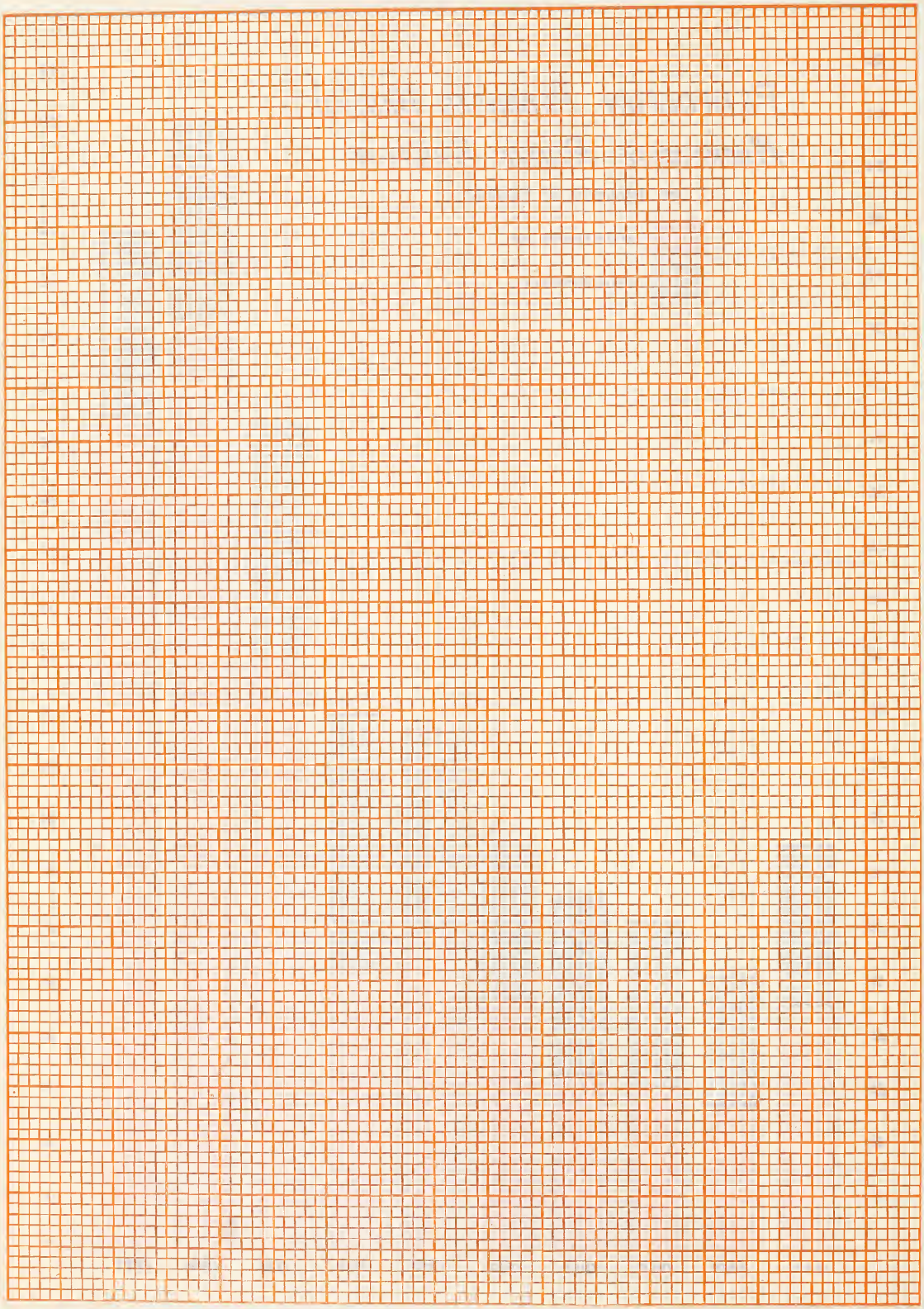
1952
1953
1954
1955
1956
1957



by Yellowknife Transportation Company Limited, Northern Transportation Company Limited hauled 69.6 per cent of the petroleum products and Yellowknife Transportation Company Limited hauled 27.6 per cent. The rest (2.8 per cent) was hauled by McInnes Products Limited.

In 1957 petroleum products were shipped by boat from three points. From Norman Wells 35,858 tons were hauled, from Hay River 13,928 tons, and from Waterways 44,837 tons. The Hay River and Waterways shipments represented imports from Alberta.

From Norman Wells the petroleum products shipped north amounted to 12,926 tons, or one third of the total. Of the two thirds moved south, 10,658 tons were shipped to Yellowknife, 2,323 tons to Hay River, 2,271 tons to Fort Smith, and 6,556 tons to Port Radium. The remainder went to miscellaneous points along the Mackenzie River.

Yellowknife received the bulk of the petroleum products shipped from Hay River (8,376 tons). 952 tons went to Fort Smith, 703 tons to Fort Simpson, 728 tons to Norman Wells, and the remaining 3,169 tons to points north of Norman Wells.

The Waterways shipment was split two ways, 39,927 tons going to the Lake Athabasca region and 4,910 tons to Fort Smith.

The table below represents the key points receiving petroleum products in 1957.

Petroleum Products Received

Place	Tons	Per Cent
Lake Athabasca Region	39,927	42.2
Yellowknife	19,034	20.1
North of Norman Wells	16,298	17.2
Fort Smith	8,132	8.6
Port Radium	6,556	6.9
Hay River	2,323	2.5
Fort Simpson	1,026	1.1
Norman Wells	728	0.8

Oil produced on a commercial scale in 1920 at Norman Wells was one of the first developments in the Northwest Territories. It was this development that introduced the airplane to the north. When the pipeline was built from Norman Wells to Whitehorse during the Second World War production increased greatly. After the war the pipeline was discontinued and production was limited to supplying the needs of the Mackenzie District. The Imperial Oil refinery at Norman Wells is now incapable of handling the increased fuel demands created by the Dew Line and the extensive program of construction in the Mackenzie District. Petroleum products have to be imported from Alberta, half of which imports consist of fuel oils and a portion is made up of alkylate used as a blending agent at Norman Wells to produce aviation gasoline.

By May 1957 there was a total of 177 wells drilled in the Northwest Territories (97 in the Norman Wells area).

The following shows some of the production figures at Norman Wells:

CRUDE OIL PRODUCTION AT NORMAN WELLS

Year	Barrels Produced	Barrels Processed
1939	20,000	
1940	18,600	
1941	23,700	
1942	75,800	
1943	293,800	
1944	1,223,700	
1945	345,200	
1946	177,300	
1947	227,500	
1948	350,500	
1949	155,500	
1950	186,700	
1951	227,400	
1952	314,200	
1953	316,700	365,689
1954	369,900	369,900
1955	404,219	400,000
1956	449,409	421,855

Source: N.W.T. Submission to the Gordon Commission. Annual Reports of the Alberta and Northwest Chamber of Mines and Resources.

Of these 109 have been abandoned and 2 suspended. Two other wells are shut in gas wells. One well was being drilled in 1957. The other 63 wells, all located at Norman Wells, are oil wells capable of producing, but only an average of 42 wells were being produced each month. Imperial Oil Limited owns all these 63 wells.[1]

The demand for heavy fuel oils increased in 1956 because of the establishment of permanent bases on the DEW Line. The demand for light products decreased as the DEW Line Airlift ended.

REFINED PRODUCTS AT NORMAN WELLS (Barrels)

	1955	1956
Naphtha Specialties	570	279
Motor Gasoline	58,186	55,884
Aviation Gasoline	64,290	60,160
Fuel Oils	138,252	211,448

Source: Annual Reports of the Alberta and Northwest Chamber of Mines and Resources.

Although no oil wells in the Mackenzie District exist outside Norman Wells, exploration in other areas is proceeding on a considerable scale. The whole area north of the Alberta boundary on the west side of the Great Slave Lake to Fort Simpson and beyond is regarded as potential oil producing area. Many companies have geological studies

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1. Mr. C. U. Daniels, Chairman of the Board, Royalite Oil Company Limited. Northern Development Conference May 1 - 3, 1957, Edmonton, Alberta.

in progress and some preliminary drilling is taking place.[2]

Progress is being made by Royalite Oil Company to produce oil from the bituminous oil sands in the Athabasca area.

> "Results from the past year's research have been satisfactory and encouraging. Progress is now being made on engineering and design for commercial operation. It appears that your company could be producing a high grade semi-refined oil from this source within a few years".[3]

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2. John Parker, Member of N.W.T. Council, Northern Development Conference, Edmonton, May 1 - 3, 1957.

3. Annual Report, 1956, Royalite Oil Company.

B. MINERAL PRODUCTS

Mineral products hauled in the Mackenzie District include such things as ore concentrates, coal, coke, gravel, sand, stone, slate, salt, asphalt, and crude petroleum.

Most of the mineral products move southward towards their market. Uranium ore concentrates form the major part of this. Other movements usually represent nonrecurrent shipments of sand, gravel, salt, or asphalt to mines and construction sites. The airplane is playing a rapidly increasing role as a carrier of the southbound ore. The following charts include the Lake Athabasca area in addition to the Mackenzie District.

SOUTHBOUND MINERAL PRODUCTS

Year	Moved by Water Pounds	Per Cent	Moved by Air Pounds	Per Cent	Total Southbound
1948	2,796,802	66	1,423,080	34	4,219,882
1949	3,671,182	76	1,147,600	24	4,818,782
1950	4,696,465	78	1,350,810	22	6,047,275
1951	5,202,103	83	1,065,690	17	6,267,793
1952	3,755,852	76	1,208,546	24	4,964,398
1953	4,930,570	75	1,646,706	25	6,577,276
1954	3,617,729	61	2,315,711	39	5,933,440
1955	3,470,235	53	3,087,551	48	6,557,786
1956	1,426,794	21	5,421,247	79	6,848,041

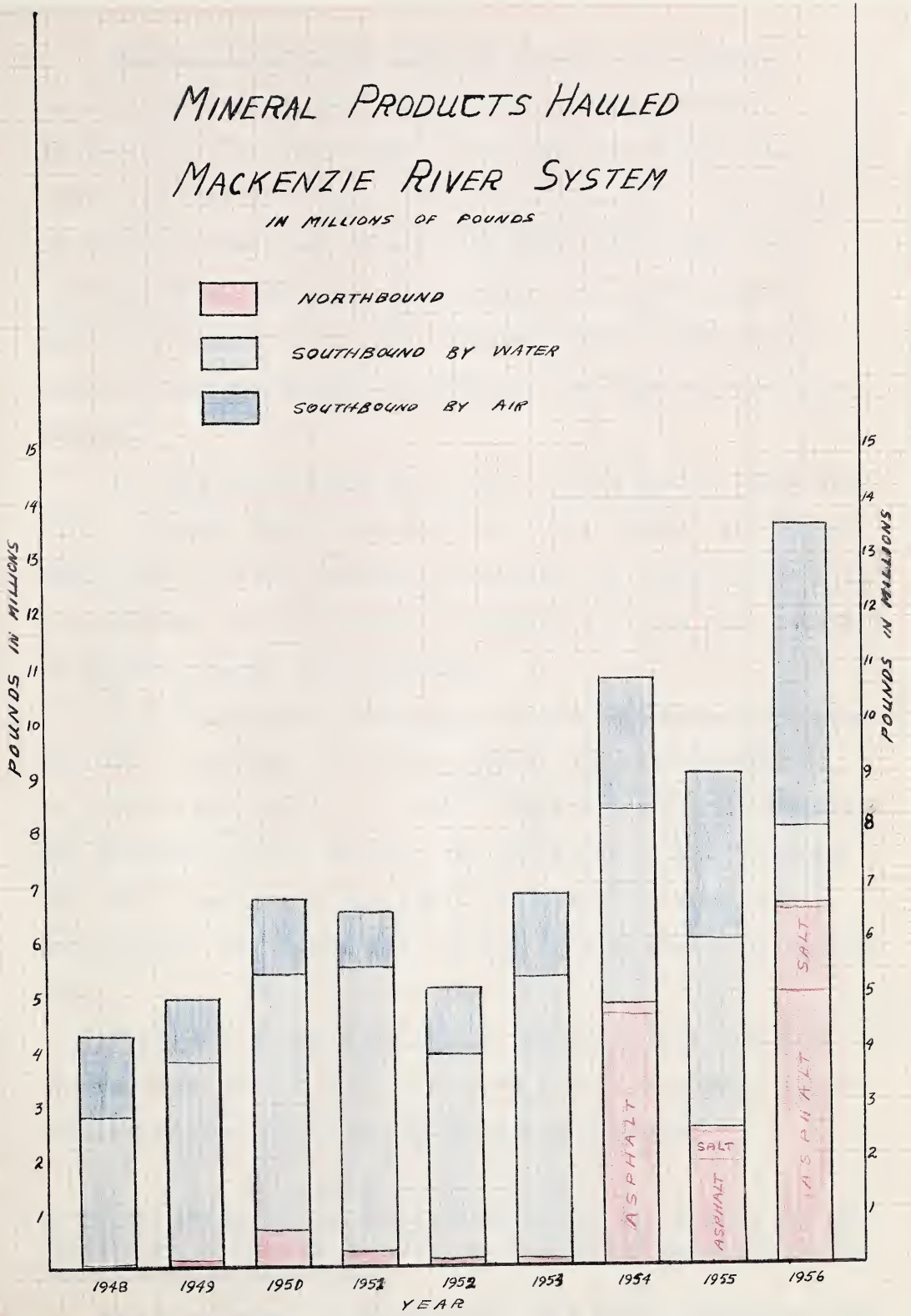
NORTHBOUND MINERAL PRODUCTS

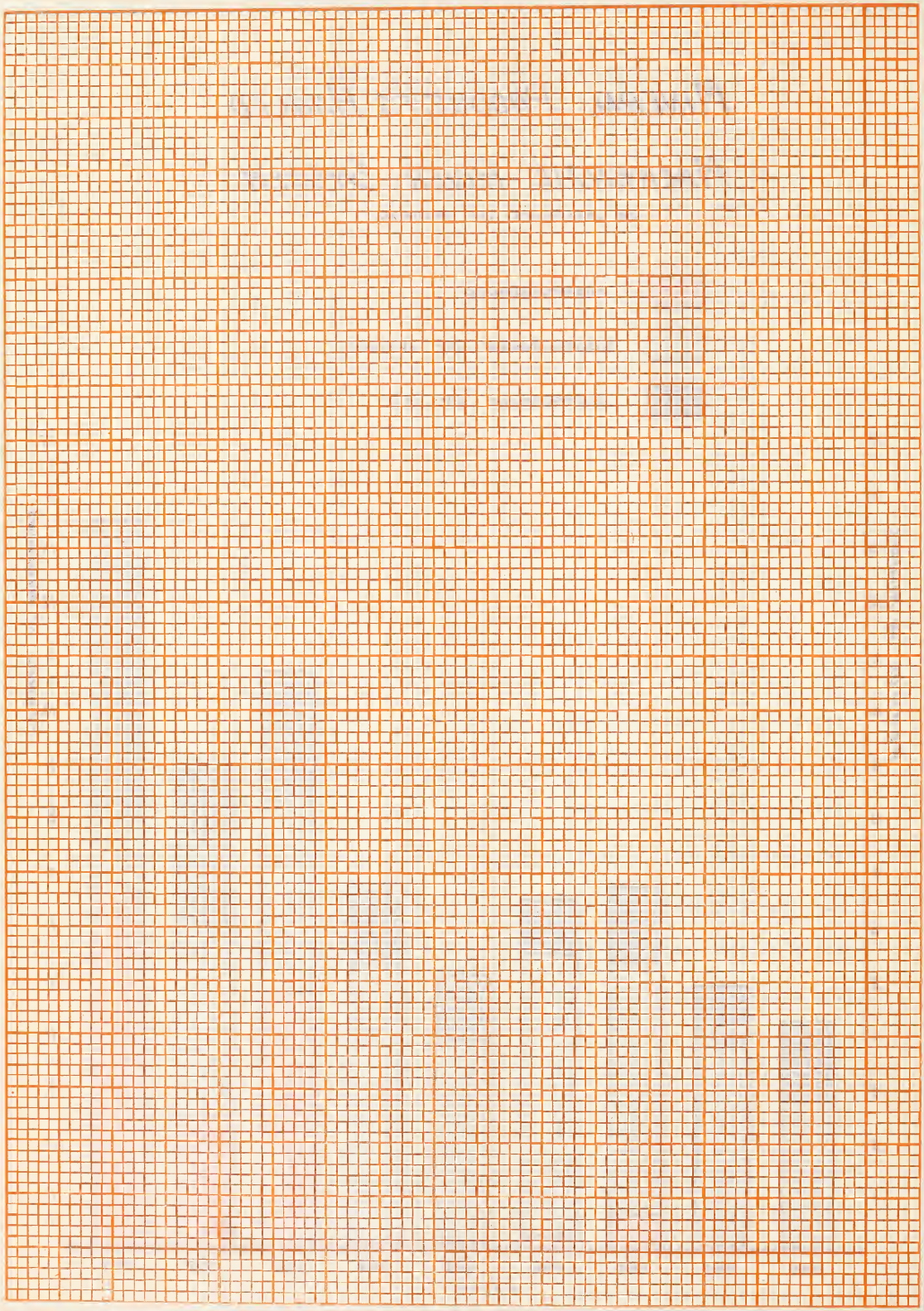
Year	Pounds
1948	2,545
1949	148,751
1950	705,238
1951	307,896
1952	140,578
1953	133,390
1954	4,808,743[1]
1955	2,502,043[2]
1956	6,628,259[3]

1. 4,600,000 pounds of asphalt to Yellowknife for airport construction.

2. 1,900,000 pounds of asphalt to Yellowknife for airport construction. 500,000 pounds of salt (NaCl) to mines at Lake Athabasca.

3. 5,000,000 pounds of asphalt to Fort Smith for airport construction. 1,500,000 pounds of salt to mines at Lake Athabasca.


MINERAL PRODUCTS HAULED
MACKENZIE RIVER SYSTEM
IN MILLIONS OF POUNDS
NORTHBOUND
SOUTHBOUND BY WATER
SOUTHBOUND BY AIR
POUNDS IN MILLIONS
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
ASPHALT
SALT
ASPHALT
SALT
ASPHALT
1948
1949
1950
1951
1952
1953
1954
1955
1956
YEAR



Remoteness and difficulty of terrain and climate have limited the mineral exploration in the Mackenzie District to scattered areas. But even this little has confirmed that the region is rich in minerals. The first systematic survey was made in the Great Slave Lake area in the 1930's. Helicopter operations of the Geological Survey of Canada since 1952 revealed about 15,000 square miles of territory worth prospecting for base and precious metals.[4]

In 1930 pitchblende was found at Port Radium where the first Canadian radium was mined in 1933. During the Second World War the first Canadian production of uranium came from Port Radium. A rich uranium discovery has been made recently at Rayrock, north of Yellowknife.

Gold discoveries at Yellowknife in 1933 began producing in 1935. The value of annual output rose from $2 million in 1947 to $10 million in 1954.[5] Except for Eldorado Mining and Refining at Port Radium, all the mineral production in the N.W.T. section of the Canadian Shield is from these gold mines. The production of gold is very sensitive to its price.

There are copper deposits in the Coppermine district and the East Arm of the Great Slave Lake. Because of their remoteness none of these has proven exploitable.

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4. J. M. HARRISON, "Geological Nature of the N.W.T. and the Prospects for Mineral Development," N.W.T. Submission to the Gordon Commission, 1955.

5. Dominion Bureau of Statistics, Gold Mining Industry, 1955.

Future prospects are quite promising in the production of lead and zinc in the Mackenzie District. Foremost among these are the deposits at Pine Point, near the south shore of the Great Slave Lake. These deposits, estimated at 60 million tons, may develop into the largest lead-zinc mines on the continent. Most of the area is claimed for Consolidated Mining and Smelting Company of Canada by Pine Point Mines Limited. The ore here would be easy to mine and treat. These deposits have been known since 1898. Less spectacular lead-zinc deposits, located at Indian Mountain Lake, 120 miles east of Yellowknife, are awaiting better transportation facilities.

Development of any of the non-metallic minerals (coal, petroleum, natural gas, salt, and gypsum) known to be present in the Northwest Territories depends almost entirely upon the degree of exploration drilling for oil.

Future development of the mineral resources in the Mackenzie District depends on transportation facilities. Present mines and prospects are but a fraction of what the geology of the region promises. Exploration would boom with the growth of transportation.[6] Base metals production is especially dependent upon economic means of transportation on a large scale.

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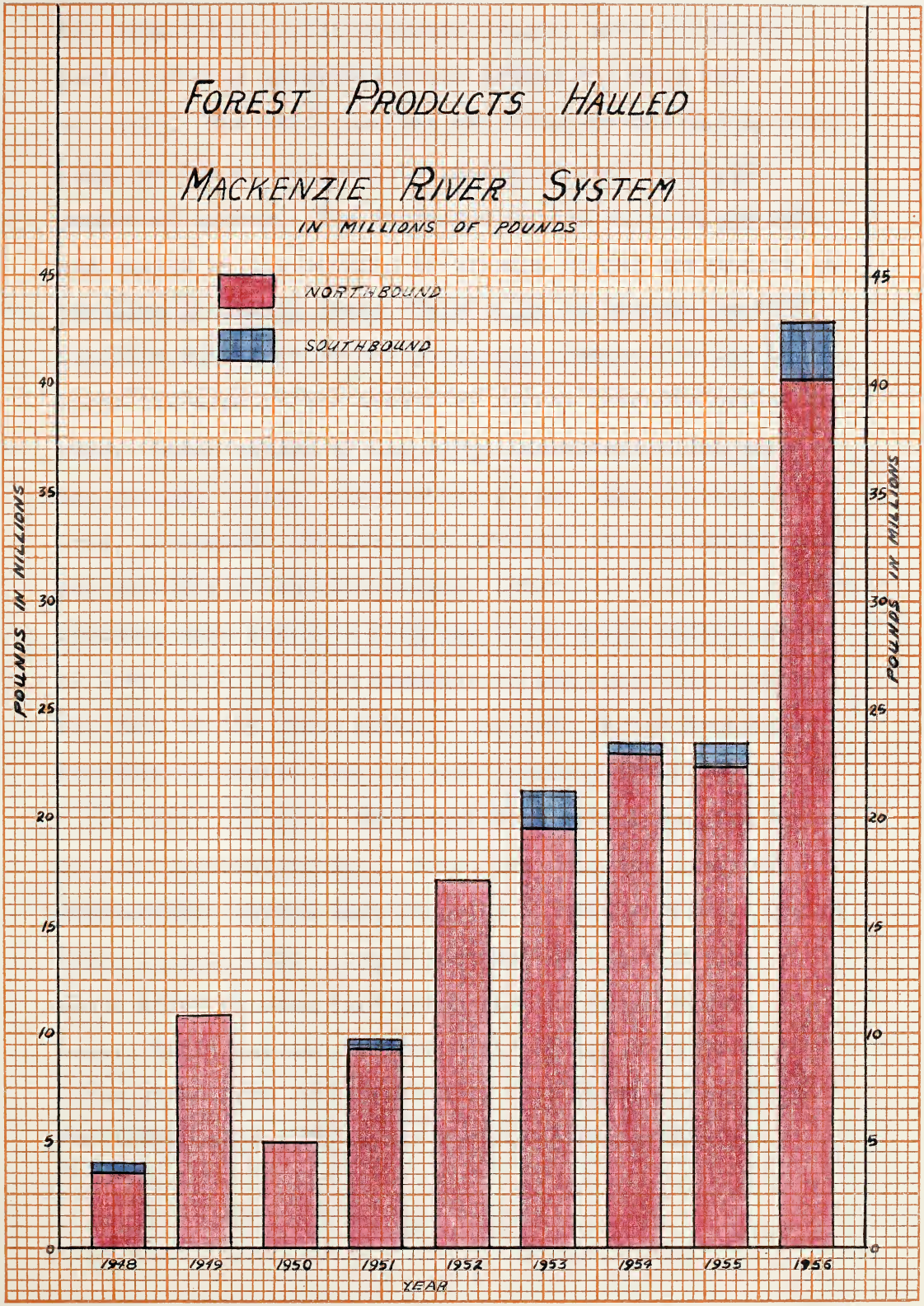
6. R. G. ROBERTSON, A Brief Presented to the Royal Commission on Canada's Economic Prospects, (November22, 1955).

C. FOREST PRODUCTS

Forest products include such items as lumber, timber, log posts, poles, piling trees, cordwood, plywood, and crate material. Forest product movements show rapid changes from year to year but are holding close to the 1948 - 1956 average of 8.3 per cent of the total physical volume of freight hauled. The nature of the demand for forest products explains the year to year changes. These products are required at construction sites that are located at different places from time to time. Any new development project is likely to raise

FOREST PRODUCTS HAULED

Year	Per Cent Northbound	Per Cent Southbound	Per Cent of Total
1948	4.5	1.3	3.5
1949	17.2	0.1	11.3
1950	7.3	---	4.5
1951	10.3	1.2	7.7
1952	12.9	0.1	10.0
1953	13.2	3.8	11.0
1954	13.6	0.9	10.5
1955	8.5	2.1	7.4
1956	9.5	5.2	9.1


FOREST PRODUCTS HAULED
MACKENZIE RIVER SYSTEM
IN MILLIONS OF POUNDS
NORTHBOUND
SOUTHBOUND
POUNDS IN MILLIONS
0
5
10
15
20
25
30
35
40
45
1948
1949
1950
1951
1952
1953
1954
1955
1956
YEAR

the demand for forest products greatly over a limited period of time after which the demand may drop back abruptly. The 1949 boom was generated by the accelerated construction at Yellowknife requiring over 5,000,000 pounds of lumber. The increased demand starting in 1952 was caused by the opening of uranium mining operations in the Lake Athabasca area. This began to dwindle by 1955. Dew Line construction was partially responsible for the large increase in the amount of forest products hauled in 1956. Other causes of the large increase in 1956 were the renewed mining construction in the Lake Athabasca area, government construction projects at Fort Smith, and the building of the New Aklavik townsite. Most of the forest products were supplied from the Slave River region north of Fort Smith and from sawmills on the Peace River near the foot of the Slave River. The land in the Mackenzie District is poorly drained even in close proximity to the major river valleys. This condition cannot support timber of high merchantability. There are only two areas of merchantable spruce that comprise a large reserve. One of these is along the Liard River and the other on the Slave River between Fort Smith and the Great Slave Lake. Small patches of spruce found along the Mackenzie River banks from Fort Simpson to Fort Norman are usable for local needs. The North Pacific Planning Project

FOREST PRODUCTS HAULED
(In Millions of Pounds)

Year	Northbound	Southbound	Total
1948	3.5	0.5	4.0
1949	10.9	---	10.9
1950	5.0	---	5.0
1951	9.3	0.5	9.8
1952	17.0	---	17.0
1953	19.5	1.8	21.3
1954	23.0	0.5	23.5
1955	22.3	1.2	23.5
1956	40.2	2.7	42.9

estimates the total merchantable and accessible merchantable timber in the Mackenzie District at 500,000,000 board feet.[7]

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7. The North Pacific Planning Project, Canada's New Northwest, 1947.

D. AGRICULTURAL PRODUCTS

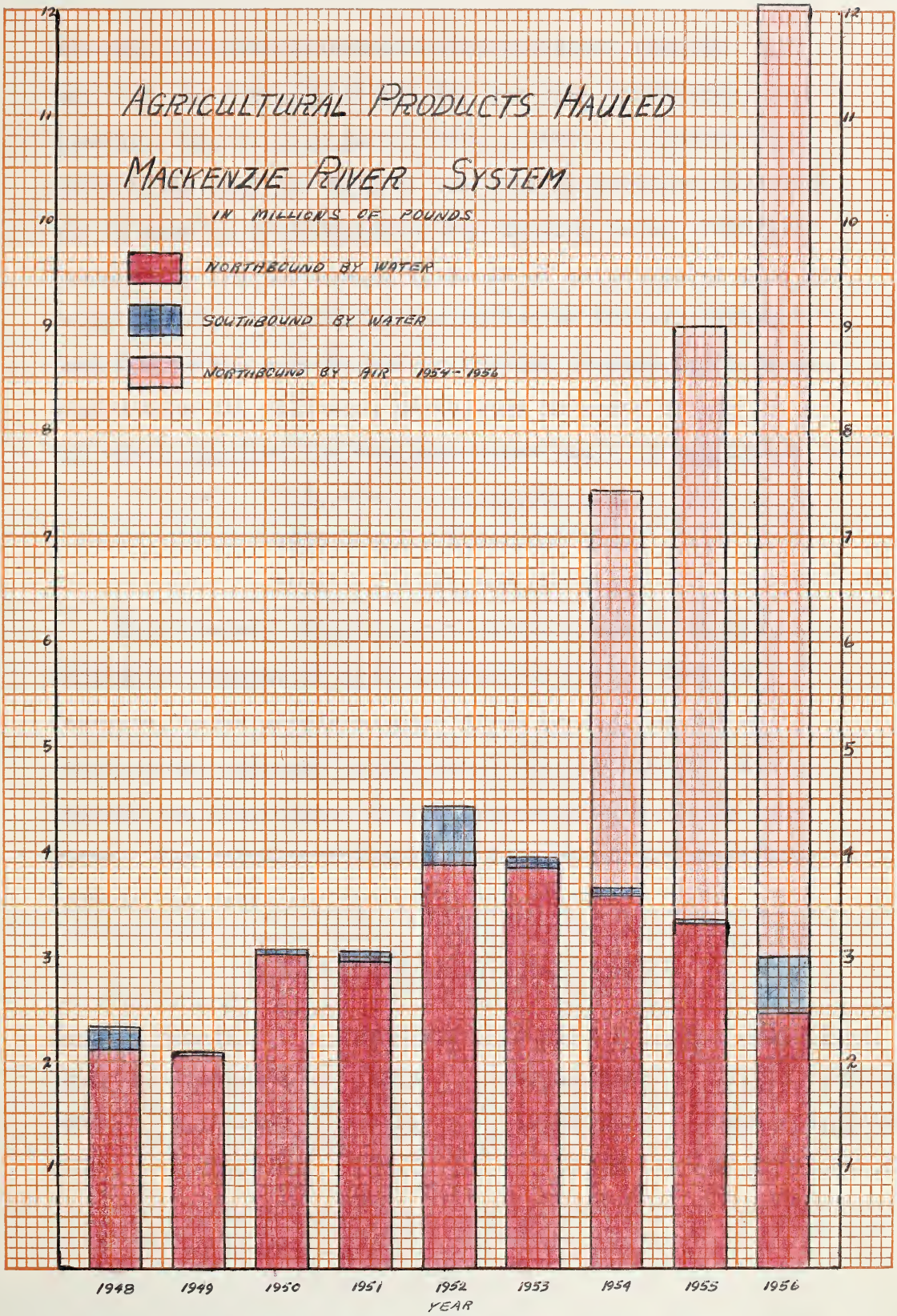
According to the Board of Transport Commissioners' classification, agricultural products include such things as grains, flour and mill products, fruits and vegetables, cattle, dairy products, meats, hay, hides and leather, cotton, wool, and other non-edible animal products.

It is impossible to trace in detail the pattern of movement of agricultural products. Such products comprise a small percentage of the water freight movements in the north as shown by the following:

AGRICULTURAL PRODUCTS HAULED BY WATER

Year	Per Cent of Northbound	Per Cent of Southbound	Per Cent of Total
1948	2.6	0.1	1.8
1949	3.2	0.1	2.2
1950	4.4	0.1	2.8
1951	3.4	0.3	2.4
1952	2.9	1.4	2.6
1953	2.6	0.2	2.0
1954	2.1	0.1	1.6
1955	1.3	0.1	1.1
1956	0.6	1.1	0.6

Except for 1952 and 1956 the southbound movement was insignificant as a percentage of the whole and also was small in terms of the absolute size. The northbound


AGRICULTURAL PRODUCTS HAULED
MACKENZIE RIVER SYSTEM
IN MILLIONS OF POUNDS
NORTHBOUND BY WATER
SOUTHBOUND BY WATER
NORTHBOUND BY AIR 1954-1956
12
11
10
9
8
7
6
5
4
3
2
1
1948
1949
1950
1951
1952
1953
1954
1955
1956
YEAR

movement by water grew until 1952 and since then it has declined not only relatively but also absolutely. However, this is only part of the picture. It should be pointed out that the bulk of the freight moved northward by air is made up of foodstuffs thus leading to an overall increase in the northbound movement of agricultural products. Using the approximation, given by one of the air firms, that 80% of the northbound air freight is made up of foodstuffs then the following northbound movement by air and water combined for the last three years is suggested:

1954 - - - - 7,371,000 Lbs.

1955 - - - - 8,898,000 Lbs.

1956 - - - -11,603,000 Lbs.

This clearly illustrates a yearly increase in the northward shipment of agricultural products. Such an increase, based mostly on population growth, is not as rapid as the increase in the total freight hauled. An interesting observation is the expanding role of the airplane. The calculations used in drawing up the above data provide the basis for the following chart:

NORTHBOUND AGRICULTURAL PRODUCTS

Year	By Water Pounds	Per Cent	By Air Pounds	Per Cent	Total
1954	3,589,000	48.7	3,782,000	51.3	7,371,000
1955	3,324.000	37.4	5,574,000	62.6	8,898,000
1956	2,464,000	21.2	9,139,000	78.8	11,603,000

At least since 1954 (the latest date for which such data are available) the airplane has hauled the bulk of the agricultural products to the north. In 1956, 78.8% of the agricultural products were air freighted northward.

The early development of agriculture in the Mackenzie District materialized as a direct result of the cost of importing food supplies to the far northern fur trading posts. By 1826 gardens were kept at all posts as far north as Fort Good Hope. Later, church missions throughout the Mackenzie District became interested in developing farms and gardens. A convent established in 1867 at Fort Providence brought in some cattle and started a farm that by 1916 had 160 acres under field crops and 19 acres in vegetables.[8]

According to the Northwest Territories submission to the Gordon Commission wheat and coarse grains are grown successfully at the Fort Simpson Department of Agriculture Experimental Farm established in 1947. Root vegetables, tomatoes, berries and tree fruits are also grown. New strains suited to the north are being developed as part of the work of the experimental farm.

Surveys indicate that there may be some 500,000 acres of good ranch land in the Slave River basin and between 100,000 and 200,000 acres of mixed farming land in the Liard Valley. Various sections along the Hay River and all the way

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8. William Dickson, "Northern Agriculture", The New Northwest, Edited by C. A. Dawson, (Toronto, 1947).

down the Mackenzie are suitable for vegetable farming.[9] However, there are limitations to the ultimate use of the agricultural potential of the north. Agricultural development seems always to have been sensitive to changes in the methods of transportation. When steamship service was fully introduced in 1887 agricultural production was greatly stimulated by the introduction of cattle. However, a decline was experienced after the completion of the railway from Edmonton to Waterways in 1925. Acreage under cultivation was greatly reduced as more efficient and rapid methods of transportation lowered cost and widened the range of imported foodstuffs. Even the old dependence on game for meat lessened as fresh, frozen and canned meats began to be imported from Edmonton.

Just because it is physically possible to grow some agricultural products in the Mackenzie District (and this is the only phase of the problem that present research is concerned with) does not mean that it is economically sound. Judging from past experience agricultural production in the north is not likely to do more than supplement imported supplies to provide variety and freshness. The cost of agricultural production in the north is high. Land is difficult to clear, labour is scarce and unreliable, and the hazards of frost, drought and insects are discouraging. It can be expected that the shipment of agricultural products

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9. R. G. ROBERTSON, A Brief Presented to the Royal Commission on Canada's Economic Prospect, (November 22, 1955).

northward will continue to rise approximately at the rate of the growth in the northern market. It must be stressed here, however, that much of the foodstuffs moving in are processed rather than primary agricultural products. Increased movement here is likely to continue with population growth until such time (much later) as it is worthwhile to process in the north. This will be long delayed because of dispersed population centres. Point to point movements within the area will continue to be relatively small.

E. MANUFACTURED AND MISCELLANEOUS PRODUCTS

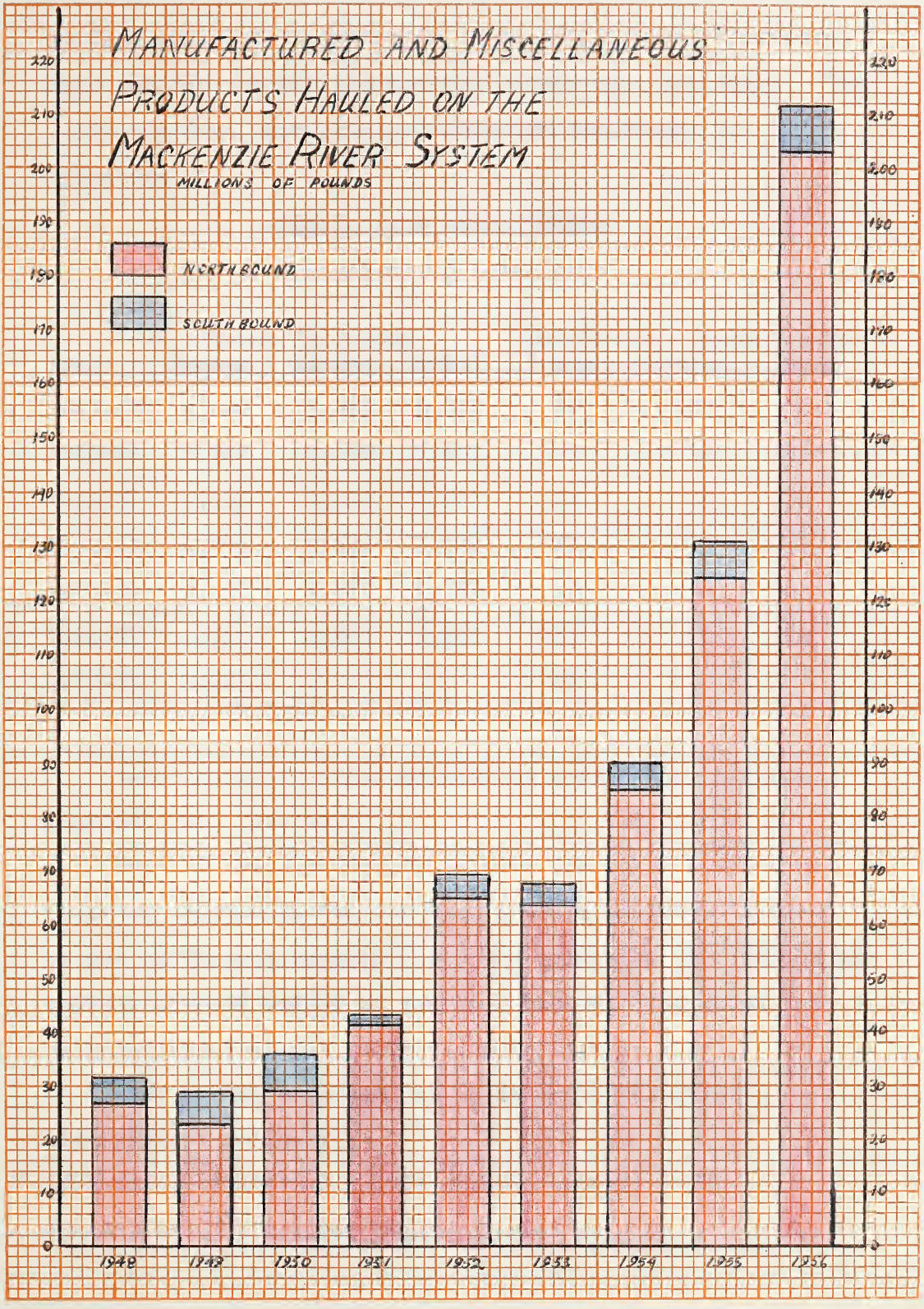
Movements of petroleum, mineral, forestry, and agricultural products have been traced. Manufactured and miscellaneous products are left to be studied. The movements of only three commodities from this category are available for analysis. These are fish, sulphur, and mail. Each will be looked at in turn.

Fish is hauled from only one commercial fishery in the Mackenzie District. It is located on the Great Slave Lake and began operation in 1945. Northern Alberta Railways reports the following amounts of fish received at Grimshaw, Alberta, from the Great Slave Lake.

Year	Dressed Fish Received (Lbs.)
1949	3,240,000
1950	5,208,000
1951	5,640,000
1952	5,064,000
1953	4,584,000
1954	5,352,000
1955	6,000,000
1956	6,536,000
1957	5,300,000

This fish haul helps to balance the northbound-southbound freight movement on the Mackenzie Highway.

There are two fishing seasons. The winter season is from December 1st to March 31st, and the summer season


MANUFACTURED AND MISCELLANEOUS
PRODUCTS HAULED ON THE
MACKENZIE RIVER SYSTEM
MILLIONS OF POUNDS
NORTHBOUND
SOUTHBOUND
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1948
1949
1950
1951
1952
1953
1954
1955
1956

is from June 1st to September 15th. Statistics, therefore, show the catches for the seasons rather than the years. The following data were obtained from the Department of Fisheries.

GREAT SLAVE LAKE FISHERY

Whitefish and Lake Trout

Year	Catch '000 Lbs. Summer	Winter	Total	Per Cent of Quota Caught Summer	Winter	Total
1949-50	4,642	3,987	8,629	93	100	96
1950-51	3,947	3,690	7,637	79	92	85
1951-52	4,130	2,523	6,653	78	68	74
1952-53	4,091	2,932	7,022	77	79	78
1953-54	3,422	2,280	5,701	60	69	63
1954-55	4,142	2,485	6,627	73	75	74
1955-56	4,845			85		

Also caught in small quantities were yellow pickerel, jackfish, and inconnu.

Some of the discrepancy between the catch and amount reported shipped by the Northern Alberta Railways is based on the difference between the round weight of the fish caught and the dressed weight of the fish hauled. The round weight-dressed weight ratio is approximately 1.2:1.

Fish quotas have been set by the Department of Fisheries as follows:

1945-46 -- 2 million pounds dressed weight.

1946-47 -- 3.5 million pounds dressed weight.

1948-49 -- 6.45 million pounds dressed weight.

1949-50 -- 9 million pounds round weight. 5 million summer season, 4 million winter season.

1951-52 -- 5.3 million pounds round weight in the summer season and 3.7 million pounds round weight in the winter season.

1953-54 -- 5.7 million pounds round weight in the summer season and 3.3 million pounds round weight in the winter season.

According to expectations in the N.W.T. submission to the Gordon Commission the fishing industry on the Great Slave Lake may expand to 12 million pounds round weight per year in the next 15 to 25 years. No more than an additional half million pounds could be obtained from the lakes near the Great Slave Lake. Development in other parts of the Mackenzie District has little likelihood of expanding beyond the growing local market.

Sulphur is hauled from Waterways to Beaverlodge, Saskatchewan; and Port Radium, Northwest Territories. It is used in the production of uranium ore concentrates. The following chart shows the amount involved.

1951 - 1956 Estimated by the Carriers.

1957 Actual Amounts Hauled.

SULPHUR HAULED FROM WATERWAYS (Millions of Pounds)

Year	To Beaverlodge	To Port Radium	Total
1951		7.0	7.0
1952		7.0	7.0
1953		6.0	6.0
1954	20.0	6.0	26.0
1955	24.0	6.0	30.0
1956	34.0	6.0	40.0
1957	39.5	11.3	50.8

Mail is hauled by air and by motor vehicle. The following shows the movement of mail by air between northern points in the N.W.T. and Uranium City and Edmonton.

MAIL HAULED BY AIR (Pounds)

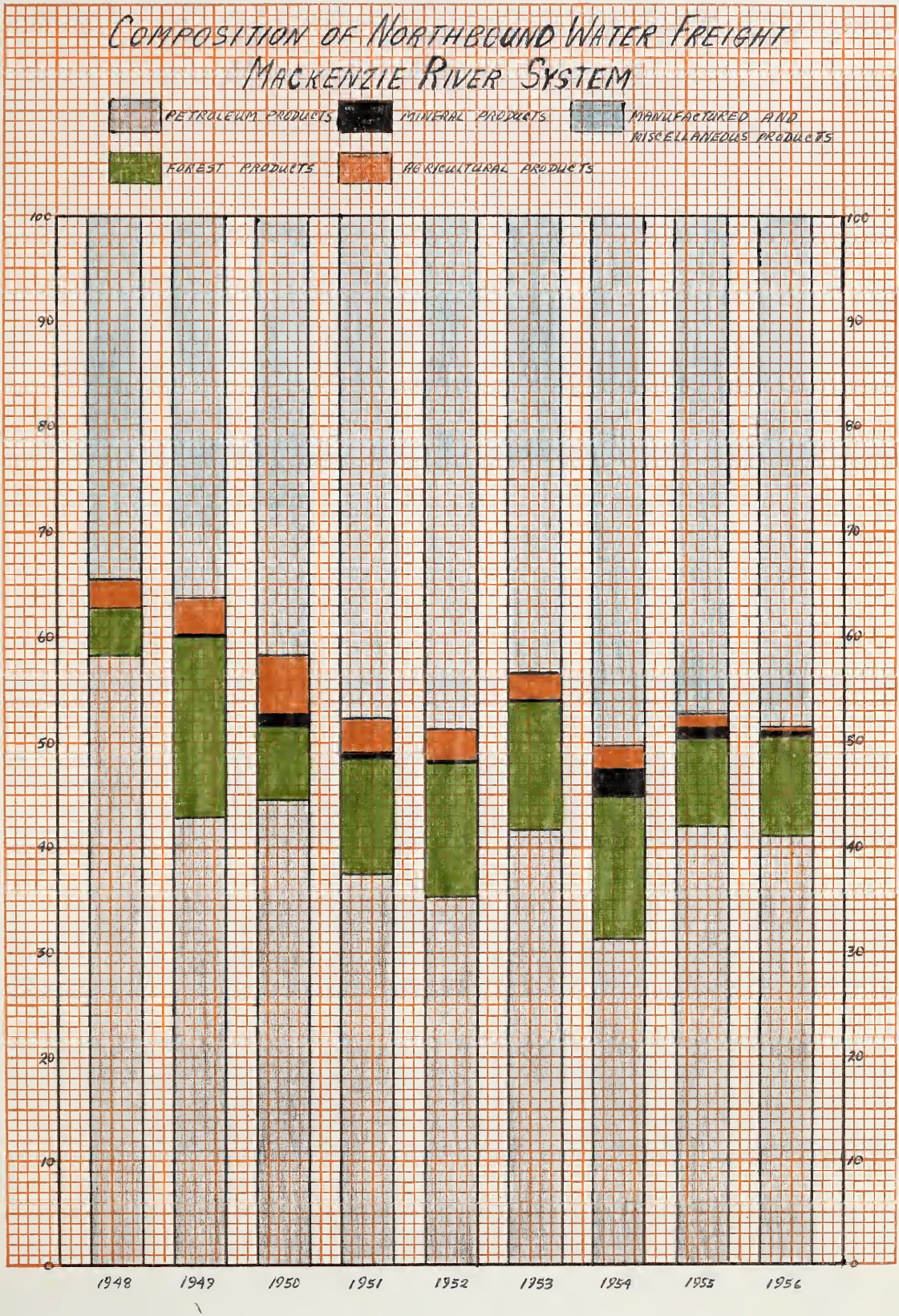
Year	To N.W.T. and Uranium City	To Edmonton
1951	376,830	75,481
1953	583,760	115,284
1954	661,271	123,575
1955	787,237	153,426
1956	940,787	187,154

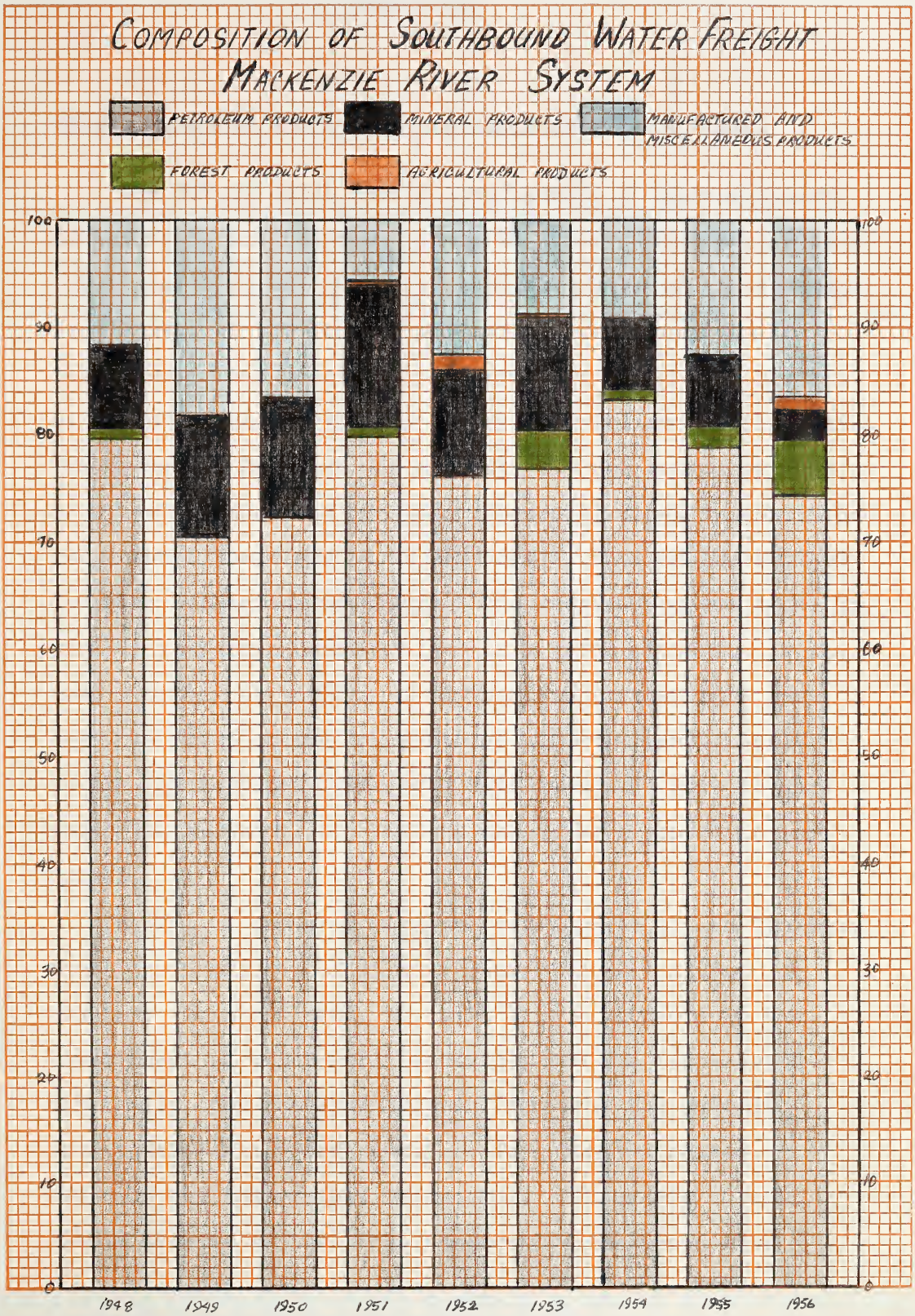
Motor vehicle service is used to ship mail from Grimshaw, Alberta to Hay River, N.W.T. The amounts involved were: 89,131 pounds in 1954, 102,972 pounds in 1955, and 117,313 pounds in 1956.

Of the manufactured and miscellaneous products hauled south from Hay River in the three years 1954-56 fish made up 47 per cent of this.

In the period 1954-56 sulphur made up 23 per cent of the northbound manufactured and miscellaneous products hauled by water, and 11 per cent of the total northbound in the same period.

COMPOSITION OF NORTHBOUND WATER FREIGHT
MACKENZIE RIVER SYSTEM




COMPOSITION OF SOUTHBOUND WATER FREIGHT
MACKENZIE RIVER SYSTEM
PETROLEUM PRODUCTS
MINERAL PRODUCTS
MANUFACTURED AND MISCELLANEOUS PRODUCTS
FOREST PRODUCTS
AGRICULTURAL PRODUCTS
100
90
80
70
60
50
40
30
20
10
0
1948
1949
1950
1951
1952
1953
1954
1955
1956

CHAPTER FOUR

FUTURE ECONOMIC DEVELOPMENT IN THE MACKENZIE DISTRICT

The future needs in the development of transportation in the Mackenzie District cannot be properly assessed without first analysing the specific characteristics of the economic development of the area in the past -- and prospects for the future. Any proposed transportation facilities need to be geared to the serving of certain specialized requirements. The Mackenzie District has not only its own unique pattern of resource endowment but also its own distinctive conditions under which these are to be developed. Most of the earlier Canadian pioneering development progressed from one stage to another conforming more or less to a given pattern. It was just a matter of pushing on further and further into new areas at first on the fur frontier but more particularly on the agricultural frontier. This cannot be done in the Mackenzie District for reasons now to be examined in more detail.

First, as compared with the development of the Canadian West, the character of pioneer venturing will differ greatly. To start with, who will be the pioneers in the development of the North? Certainly not the farmer with his family, nor the lone trapper, nor even the outdoor lumberjack working for himself. To a limited degree, it could be the independent prospector. Ultimately it will likely have to be the large corporation concerned with

developing specific areas on a large scale. No lesser scale of operation will be economically feasible. The resources of the area for many years will become evident in more or less isolated "pockets" unsuited to any other type of development because of their economic isolation.

Another condition peculiar to the Mackenzie District is the likely nature of any possible production for export purposes. As will be argued throughout most of this chapter, the Mackenzie District will have only its mineral products to export in any appreciable amount. Other resources available will be used only to supply its own needs. Nor is any great future industrial development envisaged for the Mackenzie District except along restricted primary lines. A study of the various industry prospects will bear out this argument.

Even a casual glance at the agricultural production and prospects tends to show that this industry is unlikely to grow beyond supplying a part of local needs. And even this role is optimistic if current trends of importing foodstuffs is any indication of things to come. The cost of agricultural production in the north is high. Land is difficult to clear, labour is scarce and unreliable, and the hazards of frost, drought, and insects are discouraging. Moreover, these are only a few favourable agricultural "pockets". After all, about three-quarters of the Mackenzie District is in the Canadian Shield. The raising of livestock may provide some hope. Any shipment of agricultural products that may be encountered would be only northward

within the area. No southward movement at all can be expected. The agricultural industry may grow in absolute size as the population increases in the Mackenzie District but it will never increase in relative size.

The forestry products industry presents more of a bright spot. Existing stands of timber could make the area self-sufficient in its needs for selected forest products, mainly spruce products. Booms of residential, mining and service industry construction in the north could well be supplied in the main from within the Mackenzie District. Timber stands in the Slave and Liard River valleys are situated in close proximity to the area where most of the future development of the north can be expected. They are also reasonably close to existing main routes of water transportation. Although only spruce is available, it is well adapted to all types of general and mining construction in the north. There are good prospects for use of much creosoted timbers for supports of above-ground construction under perma-frost conditions. These stands of timber, if not used in the north, are too distant from existing markets to have economic value. They could never be economically developed for export to other regions. On the other hand, the heavy and bulky forest products are of a relatively low value and local supplies can compete favourably with imports that would be costly to transport. Another cost advantage over lumber moving into the area is the avoidance of transport costs over the Fort Smith - Fort

Fitzgerald portage. The timber stands in the Mackenzie District are all located right at accessible water routes. The bulky nature of the product makes it well adapted to water transportation.

Another favourable aspect of the forestry industry is its ability to provide winter employment to absorb seasonal employees from construction and mining projects frequently carried on only in the summers. Also lumbering in the north can only proceed in winter due to the insect problem and muskeg hauls.

There is a big market future for petroleum products in the Mackenzie District. The demand will be great since it is a necessary item for heating and motor fuels (for tugs, railways, aircraft, and trucks) in any type of development. For isolated developments of small and medium size, oil burning steam generation of electrical power will be an economical possibility. If production can grow no imports would be required. Attempts to find an extension of the Norman Wells field failed during the war but large reserves are expected in the area south and west of the Great Slave Lake. In addition a large exploration reserve is located on the Yukon - N.W.T. boundary near Fort Good Hope. The reserves at Norman Wells at the end of 1956 stood at approximately 53,258,000 barrels. Cumulative production to that date was 5,260,000 barrels. The present refinery capacity is 465,000 barrels per year. However, the maximum rate of 1,570,000 barrels per year was reached in September, 1942. The Norman

Wells refinery is centrally located. Norman Wells supplied approximately 68 per cent (272,000 barrels) of the 400,000 barrels of petroleum products required in the Mackenzie District in 1957. Most of the remainder was shipped in through Hay River.

The favourable sedimentary basin throughout the area should meet all future requirements, but these structures have yet to be proved oil-bearing. In addition, the tar sand areas can provide asphalt for paving roads and airfields and a product for oiling gravel roads. The development of tar sands in the Athabasca area could have a substantial effect on both the northbound and southbound movements of freight in that area. The development of greater production of petroleum products hinges on the degree of subterranean oil exploration, not on the outside market. Development in the north would not be as costly as importing petroleum products under anything like present conditions. Petroleum products are hauled in river barges. For delivery off the river some more flexible media must be used. Aircraft are not well suited for such a function. Pipe lines are more adaptable for the purpose, but are expensive for refined products where batching may be required unless a large movement to concentrated markets can be built up.

Although fish has definite prospects as an export item, this item is not likely to influence the future to any great extent. The effect will be relatively neutral since future

catches are not expected to increase very much. Also, the methods of transporting fish have been basically standardized.

The key to the development of the Mackenzie District lies in the mining industry. This is the only export industry of any great potential size in the north. Any argument that it is economically important to develop the Canadian North must hang on the belief that the world's demand for minerals is increasing more rapidly than the ability to supply at current costs.

> "The northland is a treasure house of minerals and raw materials of all kinds. Virtually every known metal can be found and authorities in the field of northland geology seem to agree that to date only the surface has been scratched in prospecting and drilling."[1]

So far only precious metals have been exploited. As shown in Chapter Three, there are large reserves of base metals in the area ready for development (zinc, lead and copper). Most of these are located in the Great Slave Lake area. Most of the expected near-future development in the mining industry centres around these base metals.

> "The past 10 years have seen considerable prospecting and some preliminary development in base metals. These are what Canada and the world will need and these we shall be able to supply on a scale which to most people today would appear incredible."[2]

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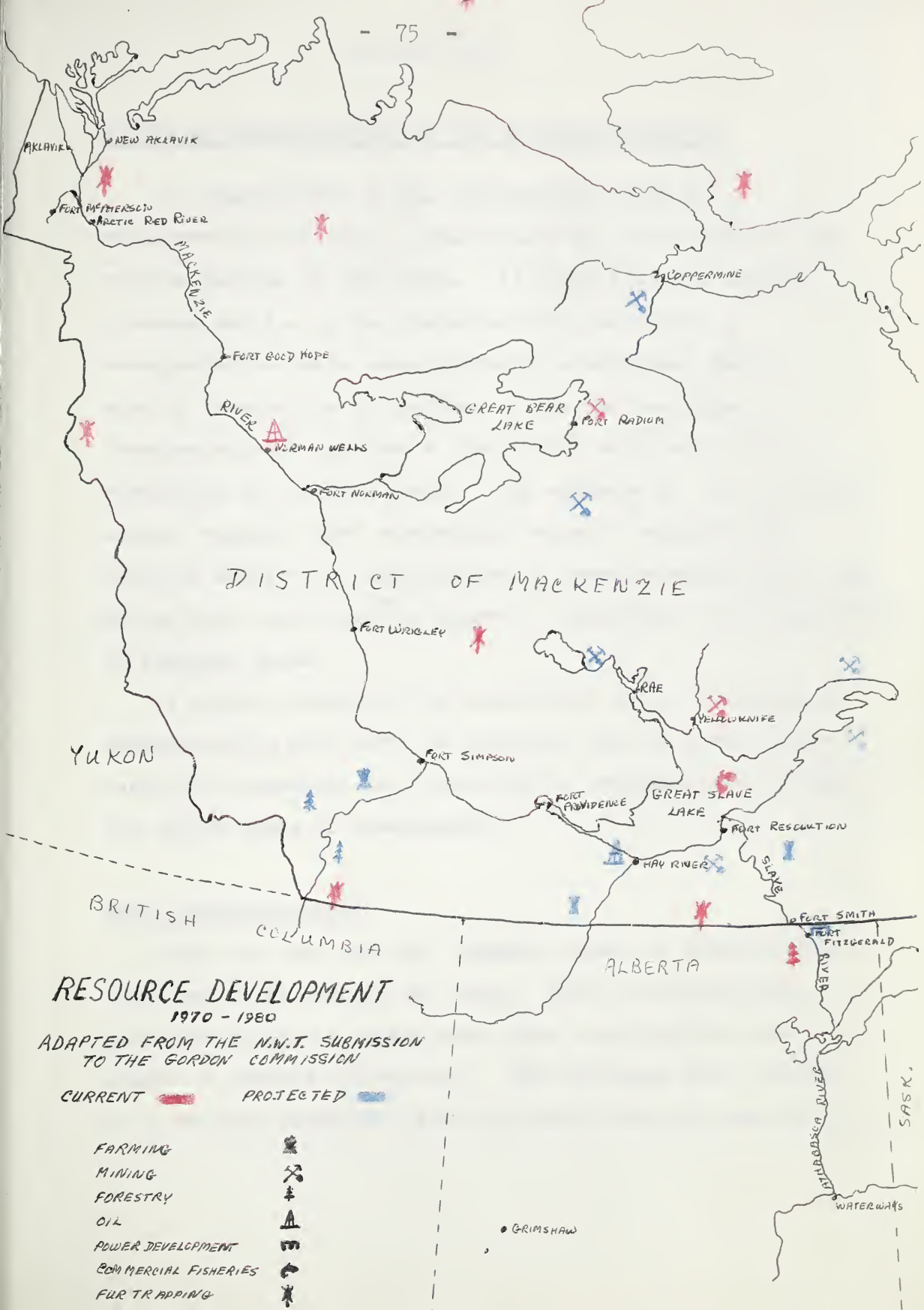
1. B. A. LINDBERG, Northern Development Conference, May 1 - 3, 1957, Edmonton, Alberta.

2. JOHN PARKER, Northern Development Conference, May 1 - 3, 1957, Edmonton, Alberta.

This has very definite implications for transportation since base metal ore is heavy and bulky, and consequently of low value per unit weight or volume. Other minerals also found in the area are gold, silver, uranium, asbestos, lithium, tantalum, columbium, sulphur, salt, limestone, coal, beryllium, iron, cobalt, nickel and cadmium. Many of these are likely to be developed soon also.

The Mackenzie District will never develop as an integrated industrial area. Only "pocket" development by large corporations economically motivated can be expected. In time some industrial metropolis may evolve, for example, Yellowknife. Smelting and refining along with some secondary industry and commercial services may be developed. But this can come only after the other developments have reached a very large scale and population has increased sufficiently to warrant a local centre for distributive services. By that time the loss of base metal ore as a cargo for the main transportation artery to the outside (probably railway) will be replaced by more general cargoes required for the more diversified industrial expansion. The role of transportation may change but the overall demand for transportation services is not likely ever to decrease.

The development of transportation facilities depends on the size and pattern of exports of mineral products and imports of everything except forest and petroleum products and some agricultural products. Only a more thorough analysis concerning the special requirements of these industries can bear further on the conclusions.


AKLAVIK
NEW AKLAVIK
FORT MCPHERSON
ARCTIC RED RIVER
MACKENZIE
COPPERMINE
FORT GOOD HOPE
RIVER
GREAT BEAR LAKE
FORT RADIUM
NORMAN WELLS
FORT NORMAN
DISTRICT OF MACKENZIE
FORT WRIGLEY
RAE
YELLOWKNIFE
YUKON
FORT SIMPSON
FORT PROVIDENCE
GREAT SLAVE LAKE
FORT RESOLUTION
HAY RIVER
SLAVE
BRITISH COLUMBIA
FORT SMITH
FORT FITZGERALD
ALBERTA
RESOURCE DEVELOPMENT
1970 - 1980
ADAPTED FROM THE N.W.T. SUBMISSION TO THE GORDON COMMISSION
CURRENT
PROJECTED
FARMING
MINING
FORESTRY
OIL
POWER DEVELOPMENT
COMMERCIAL FISHERIES
FUR TRAPPING
GRIMSHAW
ATHABASCA RIVER
WATERWAYS
SASK.

CHAPTER FIVE

FUTURE OF TRANSPORTATION IN THE MACKENZIE DISTRICT

At present each of the conventional types of transportation is used to some extent in one or other of the various regions of the north. It seems from the details produced earlier on the obstacles which each form of transportation meets under different conditions, that a careful integration is required of the various types of transportation to produce a flexibility which will allow adaptation to changing needs. The evidence in the preceding chapter suggests that substantial economic expansion has occurred despite the difficulties of transportation rather than having been encouraged in any degree by adaptation of transportation to changing needs.

A careful review of the limitations met in each type of transportation will serve to bring out the two great future needs of integration and innovation in transportation to serve the future needs of development.

Water Transportation.

This has been the most important method of transportation since man first entered the North. Water transportation, particularly in the region here under consideration, has a number of serious limitations. The Mackenzie River system, on a strictly geographical and physical basis, is less well

adapted to transportation than many of the great river systems in the world.

To begin with, located as it is in the northern latitudes, the Mackenzie River provides only a very short navigation season. Few complex industrial developments can progress smoothly and efficiently with a transportational system that is available for only a few months. The Great Bear Lake area is open to navigation for only 2 or so months of the year, the area around Great Slave Lake for about 4 months, and the Lake Athabasca region for over 4 months. Thus the yearly overhead costs are spread over approximately four months. In comparison with a number of other great water systems more favorably located geographically, the unit overhead cost on the Mackenzie River System is close to three times as high. Dependence on this type of transportation results in additional costs to those using it. For example,

> "The problem of supply becomes a very critical one. First, programmes must be planned in sufficient time to insure delivery of equipment and supplies during the open season of navigation, and second, a very large inventory of supplies must be carried during the period of closed navigation." 1

Mr. Bennett adds that a mine opening can be delayed a year if there is but a small delay or oversight in the ordering or delivery of supplies. No advanced industry can work so far north on a three to four month basis. This suggests that the use of the river will gradually become restricted to movements

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1. W. J. BENNETT, "Transportation in the Uranium Areas of the N.W.T.", Canadian Mining and Metallurgical Bulletin, (Dec., 1952).

of bulky and extraordinary freight for specific expansion, like the D.E.W. Line or the development of Uranium City. It has been shown in Chapter Two that these types of development have been quite common in the past. It has also been suggested in Chapter Four that sporadic and isolated developments of this sort are likely to characterize growth in the future.

The next major shortcoming of the Mackenzie River water system arises from its purely physical characteristics. The river is fast flowing with numerous constrictions(rapids, portages, and shallows) and unavoidable intermittent large bodies of water. The construction of floating equipment involves a costly compromise in the design of tugs and barges suitable for use under the wide variety of such physical conditions on the lakes and rivers. Compromises are adequate for early stages of development but are less adaptable for large freight volumes in concentrated form. It is likely that part of the water system will ultimately develop along the lines of the Great Lakes system where there are separate lake and river freighters. In that instance it was found that transhipment was less costly than compromises in the construction of equipment. It is possible to foresee large lake freighters being used to shuttle or ferry cargo across the Great Slave Lake or Lake Athabasca. These could hook up with highways or railways, or for transhipment to lighter river barges. This would mean that neither shallow-draft tugs nor shallow-draft barges would be used on the lakes since the barges would be replaced by freighters. A development of this sort would also provide an opportunity for a more

economical movement of oil products on a specialized basis. The cost imbalance in the northbound:southbound freight movements would also be decreased.

The next considerable disadvantage of water transportation is the cost of transhipment. Warehouses, trucks, and specialized handling equipment used on the portages are year round equipment, the cost of which is spread over only a few months. Sizable operating expenses are also involved. The portages not only add to the cost of storing and handling but also cause expensive delays. The Fort Smith - Fort Fitzgerald portage lengthens transit time on the average by about five days and is the cause of two additional handlings of the freight. Because of the Bear River portage six handlings are needed between the Mackenzie River and the vessels on Great Bear Lake.

Storms, especially on the lakes, add to the costs involved through direct loss of tugs, barges and cargo as well as in the delays necessitated by frequent interruptions in movements so as to prevent disaster. Water transportation, in addition, is extremely slow as compared with road, rail, or air transportation.

Another large problem in the existing form of river transportation is the cost connected with the imbalance of the northbound-southbound freight movement. A perfect balance is not necessarily the most economical since more freight per tow can be moved down river than against the current. This applies, of course, to the rivers only. However, the northbound:southbound ratio is generally so high that the costs involved are not significantly influenced by the effect of the northward

flowing river current. For example, as determined by the analysis in Chapter Two, the northbound:southbound ratio for the 1948 - 1957 period between Waterways and Lake Athabasca was 16.6 : 1, at Fort Smith it was 10 : 1, and across the Great Slave Lake to Yellowknife it was 93:1. Between the Great Slave Lake and the Great Bear Lake the ratio was only 1.4 : 1. Here, because more freight can be moved down river per tow, the imbalance poses no great problem. The northbound: southbound ratio across the Great Bear Lake was 6.5 : 1, and the ratio north of Norman Wells was enormous since almost nothing moved southward.

The imbalance north of Norman Wells is no real problem. This movement is still a general-purpose frontier movement that is unlikely to change since few exports from the area are foreseen. Shipment is likely to continue to consist of general supplies in relatively low volumes. For demand of this kind, the more leisurely river transportation will always have a place.

The movement between the Great Slave Lake and Norman Wells is well matched in both directions. Here heavy southward movement of petroleum products can expect to be countered by lumber and supplies moving northward. It is possible that a single firm may specialize as a carrier for this stretch of the system only.

The northbound:southbound ratios in the other regions are likely to decrease as development progresses in the mining of base metals. As will be explained later, even though the ratios might still remain high, this will likely be the case only for

relatively short distances to a main trunk line. That is, the movements from places like Uranium City and Yellowknife would involve only the distances across the lakes on the shuttle basis mentioned earlier. Future development of new export industries, as shown in Chapter Four, will likely be located in similarly favourable sites.

To sum up, there will always be some river movement of freight. The use of water transportation is likely to revert, however, to the function with which it originated; that is, it will be used by companies for their own private freight hauls where suitably specialized equipment for given conditions is economical. The relative importance of the common carrier can be expected to decrease. Common carriage may tend to concentrate on such routes as across lakes to railheads in the process of concentrating freight movements from a number of different large developments for final shipment south. The lake movements are likely to take the form of freighter shuttle service without barges, or a ferry service between such points as Yellowknife and Pine Point (if it is to become a rail terminal).

Railroad Transportation.

Conventional rail transportation is apt to provide only a partial solution to the unique transportational difficulties of the north. Justification can be provided for nothing more than a single railway north to some huge development. Moreover, for a long period of time this could only operate economically enough to cover costs if all movements to and from the whole

north were to concentrate on this one trunk line. Thus a large development may tip the scales sufficiently to justify a rail line to the north, but this would only be profitable on the assumption of a feeder system being developed to nourish the line from all other points. Nor could this feeder system consist of a huge network of branch rail lines using conventional roadbeds and equipment. The north cannot develop as the West did with a closely knit network of rail lines superimposed upon a large and more or less uniformly productive agricultural area. The West also provided almost immediate two-way movements for return pay loads. Nor were alternative truck and air carriers available to western growth at the time of initial development. In the north there is likely to be an excessive inward movement before return pay loads are assured. The recent development of the freight movements in the Lake Athabasca region, as shown in Chapter Two, is an example of this situation. The northbound: southbound ratio increased steadily from 1951 to 1956, but began to decrease as soon as ore was shipped out. The non-homogeneous "pocket" developments are not likely to be able to justify the overhead of a branch railway. Development of isolated spots has to be assured of a low cost and readily available means of getting ore out. Conventional rail and roadbeds, hard surfaced roads, and seasonal water transportation are unsuited to northern climatic and topographical conditions. New methods or new combinations of old methods of transportation must be developed. This underlines the importance of further investigation concerning

new technology in the development of means of transportation more adaptable to the physical and economic characteristics of the north. Ultimately, the rail system would become much like the Mackenzie River with everything feeding into it as the major trunk line. Such a line too, would become as inflexible as the river. A possible solution lies in the development of an integrated system using such methods as piggy-back and fishy-back. Each area will likely have to develop its own peculiar solution to the task of reaching the railhead.

> "The rail line was considered as a unit in balance with other planned systems. Its immediacy in construction was considered the opening wedge of a great new expansion in the north, and from this standpoint considered vitally essential. An integrated system of air, rail and road for opening up the north, planned on an overall basis was envisaged."2

Railbed construction in the north has to be undertaken under extremely adverse and therefore high cost conditions. In the Canadian Shield area blasting of rock may be required, and in the Mackenzie River valley construction would have to contend with numerous muskegs. The key to the solution of this problem, at some stage, would not be to change the topography to fit conventional level railbeds or heavy equipment, but to adapt these to the existing physical conditions. This may mean variable gradients in the rocky terrain, and light equipment and unit loads under muskeg conditions.

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2. PAUL WRIGHT, "Our Northland - Let's Use It", Western Business and Industry, (June, 1957).

Road Transportation

Roadbeds are more flexible than railbeds in the construction of gradients. However, permafrost, temperature extremes and muskeg conditions make conventional roadbed construction for heavy traffic almost as unadaptable for northern use as railbeds. The cost of construction of permanent deep-foundation roadbeds capable of standing up under northern conditions is apt to prove prohibitive. In the future, less attention should probably be paid to the permanence of the roadbed, and more to the continuous renewal and maintenance of the road surface. A highway system in any event is not very adaptable for long haul arterial movement in terms of the export of bulky items. As explained in Chapter Four, it is to be expected that exports in the future will be made up mostly of bulky ore products. On the other hand, the need for market roads and a gathering system feeding to the rivers, lakes, and railheads could be well provided by a highway network. R. E. Harcourt, President of the Yellowknife Transportation Company, at the Northern Development Conference at Edmonton, May 1 - 3, 1957, expressed the view that a well planned network of hard surfaced highways, tied in with the waterways system, would provide the basic transportation to handle all volumes of traffic at a railway alone was used.

Hard surfaced roads are not too adaptable for northern use because of the permafrost, temperature, and muskeg conditions. Maintenance costs would be high regardless of what type of road was built. As compared with highways in the rest of Canada, the highways in the north should be of a lower capital cost offset by the higher maintenance costs. A good road in the north is not the same thing as a good road elsewhere. A well built and maintained gravel road, oiled to keep dust down, is sufficient for northern truck routes. Even if this type of road needed to be rebuilt at certain intervals, the cost would be lower than if an expensive hard surfaced road was constructed; for it, too, under northern conditions, would have to be rebuilt frequently.

> "The type of development road which is of prime importance is one which would lead from a settlement or an established transportation route into a promising mineralized or other resource area. From such a road branches could be built to mines as they are established."[3]

Air Transportation

The air shipment of freight is flexible (within the bounds of take-off and landing facilities) non-seasonal, fast, but expensive. This flexibility is limited for certain purposes because of the high cost of subsidized landing strips. Float equipment is not too useful for high

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3. R. G. Robertson, A brief presented to the Royal Commission on Canada's Economic Prospects, Edmonton, Alberta, (November, 1955).

volume shipments. For some freight movement air transportation is out of the question. Where urgency is an important factor the airplane is indispensible. The flexibility of aircraft with floating equipment is well suited to remote isolated developments prevalent in the north. Precious metals from Port Radium and Yellowknife, as shown in Chapter Two, are best shipped by air. However, the type of commercial development envisaged in Chapter Four places distinct limitations on the use of conventional air transportation facilities. It is just too costly to ship such products as base metal ores by air. A further limitation for the use of conventional aircraft, as indicated earlier in Chapter Two, is an inappropriate balance of northbound and southbound freight to assure two-way payloads. This condition is likely to persist for air carriers to the extent that bulky ore movements must be excluded as cargo. This will not permit the most economical use of aircraft — or at least conventional aircraft.

Conclusion.

Thinking now in terms of comparative costs, the lowest rates per mile resulting from the above media were brought out at the Northern Development Conference at Edmonton, May 1 - 3, 1957.

> "Present air transport cost was stated to be 16 cents per ton mile. This could be reduced to 12 cents by incorporating in the air transport fleet newer types with increased carrying capacity. On the assumption that the Mackenzie highway was

> hard topped to specifications for handling large trucks, the rate was quoted at three cents per mile.
> On the water routes costs were estimated as ranging between four and seven cents per ton mile. Using the freight rate structure across Canada, it was established that the rail rate for moving ore concentrates entailed a cost of 1 1/2 cents per ton mile."[4]

Some of these apparently show only operating costs ignoring certain overhead outlays. The various methods of transportation vary in the amounts of fixed overhead involved as well as in the matter of who bears these overhead costs. The construction of such things as road beds, railbeds, and airports must be considered. Some of the media place heavy costs on the government, others almost none.

Summing up generally, the solution of the transportation problem in the north lies in an inauguration of a feeder system from the development centres to the rivers and railheads. Two aspects of the problem present themselves. First, how are the various methods of transportation to be integrated? Second, what types of media should be used?

As brought out in numerous places earlier, the high cost of non-integration is evident. It is uneconomic to build only one standard transportation medium in the north, large transhipments are involved, and the north is vast and not concentrated. These factors suggest the need for integration to reduce cost. The integration problem is two fold. There should be a technological integration of

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4. PAUL WRIGHT, "Our Northland - Let's use it", Western Business and Industry, (June, 1957).

carrier facilities such as piggy-back, fishy-back, marine railway, or whatever else can be developed along these lines. Also corporate integration under one management may solve the problem of organizing and planning such an integration of technical facilities. A single firm might well be responsible for shipping all the way from the mines to the markets.

An analysis of the type of media to be used for the feeder system leads to the conclusion that either flexible and/or low overhead methods must be used. If the system is rigid it must be of a low overhead, if the overhead is high it must at least be flexible enough to build a large volume by catering to many different needs and areas.

One possible way of achieving flexibility is through the use of new types of aircraft, preferably the types that are not tied down to a given route or to airfields. The conventional type of aircraft may be combined with the helicopter principle or with vertically mounted piston or jet, turbo prop., or rocket engines. Lighter-than-air craft may also be peculiarly well adapted to northern freight hauls. Air barging may reduce the cost of transhipment. Another way of increasing flexibility is to use surface pipe lines or road beds that are removable. The development of new land vehicles that can move anywhere, even if expensive, would provide flexibility.

Rigid, but low overhead, systems may be provided by the use of rudimentary road beds or narrow gauge railways.

If light but more continuous loads were hauled over these, the road beds would hold out and yet provide a large stream of freight volume.

> "Dr. Hu Harries contended that overall development of northern areas might be retarded by an inflexible system such as rail transport. His plan was for an "integrated system" that would incorporate the various types of transportation that were at present available for the north."[5]

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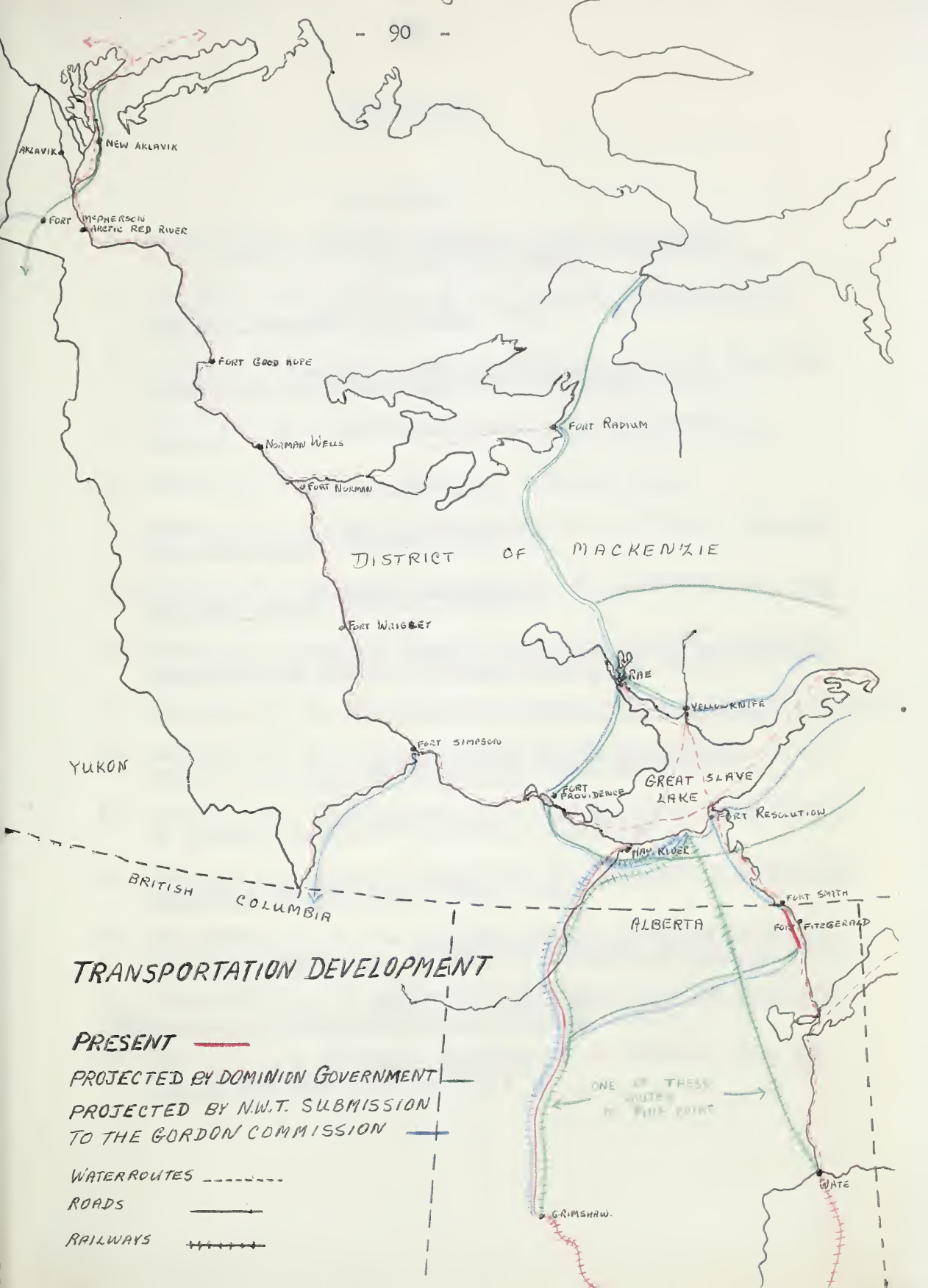
5. Ibid.


AKLAVIK
NEW AKLAVIK
FORT McPHERSON
ARCTIC RED RIVER
FORT GOOD HOPE
NORMAN WELLS
FORT NORMAN
FORT RADIUM
DISTRICT OF MACKENZIE
FORT WRIGLEY
RAE
YELLOWKNIFE
FORT SIMPSON
YUKON
FORT PROVIDENCE
GREAT SLAVE LAKE
FORT RESOLUTION
HAY RIVER
BRITISH COLUMBIA
ALBERTA
FORT SMITH
FORT FITZGERALD
TRANSPORTATION DEVELOPMENT
PRESENT
PROJECTED BY DOMINION GOVERNMENT
PROJECTED BY N.W.T. SUBMISSION TO THE GORDON COMMISSION
WATER ROUTES
ROADS
RAILWAYS
ONE OF THESE ROUTES TO PEACE POINT
GRIMSHAW
WATE

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LANDING STRIP
SEAPLANE ANCHORAGE
MOTOR ROAD
WINTER TRACTOR ROAD
STEAMER ROUTE

NORTHBOUND BY WATER
SOUTHBOUND BY WATER
NORTHBOUND BY TRUCK
SOUTHBOUND BY TRUCK

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1957

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70° 65°

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AMUNDSEN GULF
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VICTORIA I.
DISTRICT OF FRANKLIN
ARCTIC ISLANDS
QUEEN MAUD GULF
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DEASE STRAIT
DOLPHIN and UNION STRAIT
BARTER ISLAND
CLARENCE LAGOON
HERSCHEL I.
BAILLIE ISLANDS
HOLMAN ISLAND
PRINCE ALBERT SOUND
CAMBRIDGE BAY
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WOLLASTON PENINSULA
MELVILLE HILLS
PAULATUK
STANTON
UKTOYAKTUK
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ARCTIC RED RIVER
FORT McPHERSON
PEEL RIVER PRESERVE
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FORT GOOD HOPE
NORMAN WELLS
NORMAN WELLS OILFIELD
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GREAT BEAR LAKE
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SELKIRK
MINTO
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AISHIHIK
BURWASH
KLUANE
PON LAKE
WHITEHORSE
SQUANGA LAKE
CARCROSS
TESLIN
TESLIN LAKE
PINE CLAKE
WATSON LAKE
FORT LIARD
SMITH RIVER
NELSON FORKS
Nelson Forks
FORT NELSON
Fort Nelson
LIARD RIVER
ALASKA HIGHWAY
DEASE LAKE
TELEGRAPH CREEK
WRIGLEY
Wrigley
FORT SIMPSON
NAHANNI BUTTE
South Nahanni
HAY RIVER
Hay River
Fort Providence
FORT RESOLUTION
Fort Resolution
PINE POINT
SLAVE RIVER
Fort Smith
FORT SMITH
FITZGERALD
WOOD BUFFALO
PARK
URANIUM CITY
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CAMSELL PORTAGE
FORT CHIPEWYAN
EMBARRAS
EMBARRAS PORTAGE
THOMPSON LANDING
FORT RELIANCE
SNOWDRIFT
FORT RAE
YELLOWKNIFE
Yellowknife
Rae
Prosperous
Discovery Mine
Gordon
Thompson Landing
McLeod
Lac La Martre
Clive L.
Bartlett L.
Weyburn
Marian L.
Slemon L.
Russell L.
Windflower L.
Greasy L.
Willowlake R.
Horn R.
Hornell L.
Willow L.
Fawn L.
Birch L.
Gros Cap
Gypsum Pt.
Laferte R.
Mink L.
Caen L.
Dieppe
Calais L.
Mainwaring Pt.
Rocher River
Caribou Pt.
Sulphur R.
Pte. Desmarais
Under Construction
Kakisa L.
Kakisa R.
Tathlina L.
Alexandra Falls
Buffalo
Copp L.
Nyarling R.
Trout L.
Trainor L.
Redknife R.
Trout R.
Blackstone R.
Cormack L.
Poplar R.
Ram R.
Ochre R.
Fish L.
Root R.
Johnson R.
Redstone R.
Dahadinni R.
Christie Pass
Macmillan R.
Earn L.
Tay R.
Big Kalzas
Selwyn
Fort Selkirk TM
Nisling R.
Ross R.
Big Salmon
Little Salmon (abandoned)
Little Salmon L.
Drury L.
Carmacks TPT
Aishihik
Aishihik L.
Schulman
Kluane L.
Kluane
Kluane Landing
Nordenskiold R.
Hutshi
Braeburn
Lower Laberge
Laberge L.
Hootalinqua
Big Salmon R.
Teslin River
Montague
Ross River
Finlayson L.
Fortin L.
Starr Cr.
Nisutlin R.
Frances L.
Frances Lake
Quiet L.
Wolf L.
Wolf R.
Meilleur R.
Caribou R.
Cr.
Virginia Falls 316'
Flat R.
Ram R.
Nahanni R.
North Nahanni
Clearwater Cr.
Johnsons Crossing
Lakes Corner
Takhini
Wigan
Clinton Cr.
Robinson
Marsh L.
Lewis L.
Carcross TPT
Tagish
Tagish L.
Bennett
Tutshi L.
Tatshenshini R.
Dalton Post
Kusawa
Kusawa L.
Takhini R.
Haines Junction
Champagne
Dezadeash R.
Alsek R.
Dezadeash L.
Kluane Game Preserve
St. Elias Mtns.
Mt. Logan
Mt. St. Elias
Mt. Vancouver
Mt. Fairweather
White Pass
Skagway
Fantail L.
Taku L.
Atlin
Atlin L.
Surprise L.
Haines
Haines Cut-off
Lynn Canal
Glacier Bay
Lituya Bay
Gustavus
Tulsequah
Tulsequah R.
Juneau
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Boundary
Stikine R.
Iskut R.
Mess Cr.
Klappan R.
Ware
Finlay R.
Kitchener L.
Tatlatui L.
Thuade L.
McConnell Creek
Ingenika R.
Bell Irving R.
Bowser L.
Mexiadin L.
Premier
Stewart
Alice Arm
Portland Canal
Observatory Inlet
Behm Canal
Revillagigedo I.
Ketchikan
Metlakahtla
Annette Island
Craig
Dall I.
C. Muzon
C. Chacon
C. Bartolome
C. Ommaney
C. Decision
Prince of Wales I.
Strait of Juan de Fuca
Langara Island
C. Knox
Dixon Entrance
Virago Sd.
Rose Pt.
Prince Rupert
Stephens I.
Masset
Graham I.
Port Clements
McCauley I.
Banks I.
Tian Hd.
Buckley Bay
Tiell
Kennell Sd.
Kindakun Pt.
Porcher I.
Dana River
Kitimat
Douglas Chan.
Granville Chan.
Hecate Strait
Chatham Sd.
Skeena R.
Terrace
Kitsumkalum L.
Pacific
Arrandale
Rosswood
Cedarvale
Kitwanga
Hazelton
New Hazelton
Skeena Crossing
Evelyn
Smithers
Quick
Houston
Topley
Rose Lake
Burns Lake
Southbank
Colleymount
Morice L.
Morice R.
Babine R.
Babine L.
Babine
Bulkley R.
Bear R.
Bear L.
Ootsa Lake
Francois Lake
Wistaria
Fort Fraser
Engen
Vanderhoof
Stuart L.
Fort St. James
Stuart R.
Lake Landing
Donald
Sheraton
Endako
Necoslie R.
Fraser R.
Finmoor
Isle Pierre
Prince George
Tweedsmuir Provincial Park
Summit Lake
Aleza Lake
Hansard
McGregor R.
Hutton
Penny
Dome Creek
Gisporne
Crooked R.
Carp L.
Salmon R.
McLeod Lake
Monkman Pass
Pine Pass
Pine R.
Moberly R.
Parsnip R.
Peace R.
Hudson Hope
Finlay Forks
Germansen Landing
Manson Creek
MANSON CREEK
Takla Landing
TAKLA LANDING
Tsayta
Tchentlo
Takla L.
Nation R.
Chuchi
Indiana
Trembleur L.
Tezzeron L.
Kinchi
Fraser L.
Fraser R.
Fort George
Prophet River
Prophet R.
Beatton River
Beatton R.
Sikanni Chief
Sikanni
Halfway R.
Cameron R.
Blueberry R.
Dog R.
Fort Grahame
Grahame
Fort St. John
St. John
Rolla
Dawson Creek
Demmitt
Sexsmith
Hythe
Beaverlodge
Wembley
Grande Prairie
Wapiti R.
Smoky R.
Cutbank R.
Kakwa R.
Simonette R.
Narraway R.
Berland R.
Wapiti River
Sturgeon R.
Sturgeon L.
Spirit River
Eaglesham
Wanham
Woking
Tupper
Hines Creek
Grimshaw
Fairview
Berwyn
Peace River
Nampa
Springburn
Utikuma L.
Atikameg
McLennan
Culp
Grouard
Lesser Slave L.
Slave Lake
Spurfield
High Prairie
Driftpile
Kinuso
Canyon Creek
Swan Hills
Swan R.
Goose R.
Snipe L.
Assumption
Whitecourt
Green Court
Mayerthorpe
Sangudo
Glenevis
Chip L.
Pembina R.
Wolf Creek
Edson
Obed
Entwistle
Grandview
Gainford
Duffield
Edmonton
Leduc
Calling Lake
Wandering River
Pelican Portage
Conklin
Winefred L.
Margie
Behan
Wabasca
North Wabasca L.
South Wabasca L.
House R.
Peerless L.
Loon R.
Cadotte R.
Lubicon L.
Trout Lake
Graham L.
Meikle R.
Notikewin
Notikewin R.
Hotchkiss R.
Keg River
Carcajou
Buffalo
Bohverine
Wabasca R.
Bison L.
Sawn L.
Mikkwa R.
Penny R.
Birch R.
Bitumount
Fort MacKay
McMurray
Waterways
Clearwater
Wasekamio L.
Gardiner L.
Ells R.
MacKay R.
Meths L.
Lenarthurs
Kinosis
Quigley
Pingle
Conklin
Winefred L.
Peter Pond Lake
Christina R.
Athabasca
Boyle
Caslan
Hylo
Colinton
Rochester
Newbrook
Waskatenau
Smoky Lake
Spedden
Glendon
Bellis
St. Paul
Willingdon
Two Hills
Vermilion
Lloydminster
Mannville
Innisfree
Vegreville
Mundare
Fort Saskatchewan
Namao
Cooking Lake
Tofield
Holden
Ardrossan
Sherwood Park
Fort Assiniboine
Blue Ridge
Barrhead
Busby
Morinville
Onoway
Legal
Ribbons
Clyde
Thorhild
Lawamasu
Wasekamio
Meanders River
Upper Hay River
Hay Lake
Hay River
Habay
Zama L.
Koicho L.
Fontas R.
Kotcho R.
Sahtaneh R.
Toad R.
Racing R.
Gataga R.
Kechika R.
Turnagain R.
Dease R.
Dease L.
Eagle R.
Cry L.
Rapid R.
Porter Landing
Deadwood
Deadwood L.
Nahlin R.
Nahlin Landing (abandoned)
Inklin R.
Takwahoni R.
Tuya L.
Tuya R.
McDame
Sheslay
Sheslay R.
Telegraph Creek
Kindakun
Klappan R.
Sifton Pass
Pitman Tr.
Tuchodi R.
Tuchodi L.
Gathio Cr.
Besa R.
Kitchener L.
Thuade L.
Ingenika R.
Osilinka R.
Omineca R.
Omineca
Germansen Landing
Manson Creek
Takla Landing
Tsayta
Tchentlo
Takla L.
Nation R.
Chuchi
Indiana
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